RAILROAD GAZETTE

FRIDAY, JUNE 30, 1893.

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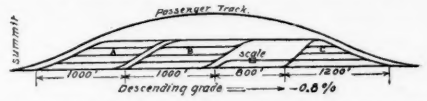
Contributions.

Plans of Freight Yards.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Acceding to H. D. W.'s demand (page 427) for additional information concerning the yard plan published in your issue of June 2, I beg to submit the attached supplemental plan. Each track in yards A. and B. to hold 25 cars or a total of 200 cars. Grade of yard 0.8 per cent.



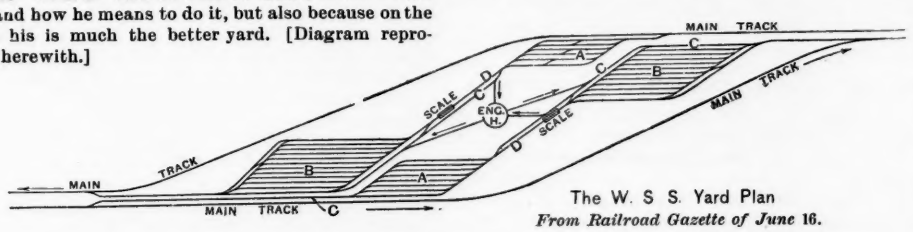
descending in the direction shown. Daily movement of cars in the direction of descending grade 120 cars, divided into eight trains of 15 cars each.

CIVIL ENGINEER.

The W. S. S. Yard Plan.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It is much easier to criticise the yard designed by "W. S. S." and printed in your issue of June 16 than it was to criticise that designed by "Civil Engineer," not only because "W. S. S." tells us what he means to do in his yard and how he means to do it, but also because on the whole his is much the better yard. [Diagram reproduced herewith.]



The W. S. S. Yard Plan
From Railroad Gazette of June 16.

Indeed, this is a better yard than are most yards in this country and largely because it is adapted to the "poling" of cars; which, as "W. S. S." justly remarks, is a quicker method than the old back-and-forth shifting, and is easier upon the cars. It might be added that it is a cheaper method, because it enables more shifting to be done with a yard plant of a given value than is possible under the old methods.

There is, however, another excellent feature of the "W. S. S." yard in that the running tracks go entirely around the yard while the engine house is between the east and west-bound yards. The moment, therefore, a train enters the yard its engine is released and can run to the engine-house without any interference by engines shifting in the receiving yard. In the same way, when a train is ready in the classification yard or on the starting-track beyond, an engine can be backed up to it without any interference by shifting engines there, all the shifting being done between the poling tracks and the classification tracks where the road engines never come at all.

It is, indeed, a most instructive lesson in the art of yard designing to compare the possiblities of this yard with those of "Civil Engineer's" yard, where cars cannot be moved from what is apparently the receiving yard into what may possibly be the classification yard without a reverse movement and an interference with the main tracks, and where the movement and housing of the empty engines has apparently not been considered at all.

After acknowledging the merits of this yard it will not, I hope, be ungracious to point out its faults. I notice, first, that "W. S. S." calls for a descending grade in the classification yards of 0.3 per cent. This would seem to suppose that the yard was built on a summit with a classification yard for one direction on one side and for the other direction on the other. Where such a summit is available the general arrangement given is, of course, a good one; and it would seem to be a good one also for a level yard inasmuch as cars can be poled on the level with success, although not so easily as on a descending grade. The plan does not, however, seem to be adapted to a yard where the grade runs all one way. In such a location the general arrangement of the Edge Hill yard, illustrated by you some years ago, would seem to be better. At Edge Hill both receiving yards are at the upper end of the yard, and trains arriving at the lower end are pulled up to the receiving yard, and the cars dropped back for classification.

The "W. S. S." yard makes no provision for the classification of trains in station order except by the ordinary back and forth shifting, which is so costly in time and repairs. Of course it would be possible to use the tracks in the classification yard in such a way that a departing train could be made up of cars from several tracks in correct station order. This, however, is not an economical way of working. It is often advisable to make up through trains with a few cars for local stations in the lead, and if a separate classification track is assigned to each of these local stations there is danger of assigning a long track to a classification which has very few cars.

I do not know that there is a similar arrangement anywhere in this country, but, to refer to the Edge Hill yard again, there is an arrangement of short tracks below the classification yards at that point which makes it possible to take a train of cars from any one classification track and re-arrange their order as seems advisable.

The figures given by "W. S. S." in regard to his receiving yard do not seem to agree with the sketch. He speaks of four tracks each of 50 car lengths with cross-overs, while one of the receiving yards in the sketch has six tracks—three pairs with cross-overs in the middle of each pair, and the other receiving yard has eight tracks and no cross-overs. Was it not intended to make of the cross-overs a continuous ladder in the middle of the yard which would allow for the reception of two 20-car trains on each track, with a fair allowance for engine and caboose as well?

It seems also as if there should be similar cross ladders in the classification yard. If the train length is 20 cars it would seem hardly advisable to fill up the classification tracks to 60 cars, which would apparently be more than any one engine could handle. If the classification yard was cut by a couple of parallel ladders this would make it practicable to hold three outbound trains on each track.

Again, there should be provisions made for cabooses so that they can be taken from the receiving yards, held undisturbed while the train hands sleep, and returned to the classification yards without interference with the shifting or with the main lines of track.

These suggestions and exceptions do not, however affect the general design of the yard, which is decidedly superior to most yard plans. H. D. W.

The M. C. B. Official Coupler Tests.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I find that the recent coupler tests made at Altoona, Pa., and at Watertown, N. Y., are to be published in detail. Having been present at these tests I would call attention to some very important points which should be carefully considered.

First, the construction of the drop foundation was such that after three or four different couplers were tested, the bed plate was bent down ⅛ in. in the centre. The plate is 2 in. thick made of four plates ¼ in. thick, 42 in. diameter. This plate lay upon a large stone in the foundation, 2 ft. × 18 in. The bed plate bent in the centre from the fact that the stone gave way by being broken. This, of course, would relieve the force of the blow at least one-third. The test of the couplers was continued until all were tested, and at the close the plate was driven down 1¼ in. All couplers tested after the first 12 or 15 blows received the benefit of the cushion, which was greatly in their favor.

I would also call attention to the manner in which the coupler was placed under the drop. If I understand the object of the test, it was intended to demonstrate the strength of the coupler by distributing the force of the blow equally throughout the whole of the coupler. This was not done owing to the fact that the coupler was clamped at a point on the shank 15 in. from the end. By means of two keys, at the bottom of the shank it was keyed so as not to move. You will note that the coupler head and knuckle stood 18¼ in. above where it was clamped by the keys. It is readily seen that there is a tremendous leverage upon the shank of the coupler at the point where it is made fast by the keys. The proper way to hold a coupler for testing is to stay it slightly around the head just enough to keep it from falling. Then the force of the blow is equally distributed throughout the entire coupler.

At the pulling test at Watertown a very essential point was left out of the programme. It is this: When the couplers were pulled up to 75,000 lbs. there should have been an examination made as to whether the knuckle and lock would work, and also at 100,000 and 125,000 lbs. This was not done in either case, so we do not know how much strain it takes to disable a coupler from service. As I understand it, the M. C. B. test is to be 125,000 lbs. and if couplers cannot be made to stand this strain and work perfectly at the knuckle and lock they should be reported as not coming up to the standard. This is the only way to bring couplers up to the requirements. COUPLER.

Vertical Plane Couplers and Standards.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with interest your article on "The Vertical Plane Coupler at the Lakewood Convention," in your issue of June 23, and agree that the tests so far as made have at least settled the question of material. When the author says "that something must be done in the way of changing the M. C. B. standard depth or breadth of shank or distance of face to buffer stop," it seems to me that he has struck the keynote. This should not pass unnoticed. If any knowledge is to be gleaned from general serviee records in the details lately published by Mr. A. M. Waitt, it seems useless to "talk coupler" without this defect being removed.

An increased length of the head will not accomplish the result, from the fact that the weight will counterbalance the gain, and there is practically but one point to be made by making the coupler head longer. By this device the knuckles would assume protection over the bar lugs on curves should the knuckle nose receive a blow from an adjacent coupler when thrown over to the jaw side. In couplers with the 8¾ standard head the leverage of the knuckle nose will average 4½ in. against 2 in. The longer, being the point of contact, throws the entire shearing stress on the lugs, which is the cause of their breaking. The locks in many types lack room, and some manufacturers have taken up several degrees of the contour lines to get room for the lock. Such couplers have no clearance on curves and will not pass the gauges. Therefore, with a head of 9¾ in. in length, one very valuable feature is attained with an increase of weight equal to 5 or 7 lbs. per coupler for some types, while others would remain practically the same as now.

If such a step is contemplated it should be acted upon at once, for delay would put into the market two classes of knuckles—one by makers who *can* make the change, and another by those who *cannot* make such changes. This would necessitate many expensive alterations. The coupler question has assumed such a degree of importance that the standard should be settled as early as possible.

Referring to paragraph (o), in which the author says: "Simplicity is a desirable feature of all railroad devices, but the least number of parts in a coupler does not necessarily make the simplest design. Simplicity should be understood to mean in this case that there are few important parts, and that these parts have a simple shape and function, and are not liable to be lost, broken or get out of order, and can be readily replaced"—this point is well taken, but it should be considered from the advantages derived. Simplicity of operation is far more valuable with some complication of parts than the simplicity of construction which requires great care and skill to operate and which causes shocks and throws. Of the many attempts at couplers, there was, first, the link and pin—the lost cause; second, the non-cushioned type—the lost hope; third, the cushioned M. C. B. type—the fittest to survive and the choice of the trainmen.

Some manufacturing plants purpose to use extra fine grades of metal to meet the lack of valuable features. Why not surmount the question by taking up that which is adapted to meet all the requirements in service with the least change, and settle the question by the adoption and manufacture of a single pattern which shall be guaranteed to give certain service with an average material? In this way the difficulties referred to in the article, paragraph (q), will be overcome.

The location of pivot joints may cause the difficulty experienced in coupling mentioned in this paragraph (q) of the article. Sometimes couplers cannot be coupled unless both knuckles are open, but any coupler that complies with the limits of the M. C. B. gauges will couple if the knuckle pivots are not too far back.

The present situation of the coupler question, as I view it, and as gathered from reports, tests and service up to date, is about as follows: First. That the breakage of guard arms (in the non-cushioned type) is 82 per cent. Second. That deadblocks, if used, are a makeshift without value when they are most needed. Third. That the cushioned M. C. B. type has shown only about 1 per

cent. guardarm breakages in several years' service. Fourth. That the cushioned carrier is a means of furnishing extra protection for M. C. B. couplers. Fifth. That no coupler company can undertake to furnish sufficient couplers for the heavy freight traffic of to-day. Sixth. That the shocks of coupling may be absorbed by cushioned draw gear. Seventh. That *some one* has *the* coupler, and that others have the plants, and are in a position to manufacture that coupler on a royalty, and thus bring about the universal adoption of the best type of coupler. This were better than to depend entirely upon the grade of metal to compete with better designs and forms.

A. W. VAN DORSTON.

Profiles of Five Trans-Continental Railroad Lines.

The profiles published herewith show the Canadian Pacific from Port Arthur to Vancouver, the Great Northern from St. Paul to Everett, the Northern Pacific from St. Paul to Tacoma, the Union Pacific from Omaha to Portland by way of the Oregon Short Line, and the Atchison, Topeka & Santa Fé from Kansas City to National City, the San Diego terminus. The tables of grades and distances summarize the most important items of information given on the profiles from which these engravings are reduced.

One must be struck by the advantage which the Northern lines have over the Southern in the ruling gradients and in their distribution. It will be observed that the Canadian Pacific crosses the continent with the least total elevation of all of the lines. As far west as Medicine Hat, nearly 2,100 miles from Montreal and 660 miles west of Winnipeg, its ruling grades both east and west are 53 ft. to the mile, and the sum of all the grades is between 12,000 and 13,000 ft. from Winnipeg to the Pacific either way. Westward for 200 miles more the grades continue comparatively light, and the heavy grades over the Rocky Mountains and the Selkirks are bunched in 200 miles. Heavy but short grades are found again over two minor summits.

The Great Northern has still more favorable grades. For over 960 miles, from St. Paul to Minot, the maximum grades, east and west, are 32 ft. to the mile, and the main Rocky Mountain summit is passed with a grade west of 53 ft. and east of 105. Then the Cabinet Mountains are passed with ruling grades of 79 ft. to the mile. All of these heavy grades are concentrated in 300 miles, but between Spokane and Everett short but heavy grades reaching 116 ft. are encountered crossing the Cascades. The intervening grade between the slopes of the Cabinet Mountains and of the Cascades are moderate.

The Northern Pacific has a somewhat less favorable profile than the Great Northern or the Canadian Pacific. The sum of the grades either east or west is greater for a like distance. For the first 666 miles out of St. Paul the ruling grade, east and west, is the same as that of the Canadian Pacific, 53 ft. to the mile, as compared with 32 for the Great Northern. Then there is a stretch of 341 miles with lower grades than either of the more northerly roads, namely, 26 ft. to the mile. The summits of three ranges are passed in 300 miles with ruling grades of 116 ft. to the mile, which, it will be observed, is higher than anything reached on the Great Northern except over the Cascade summit. Then there is a distance of 485 miles, with ruling grades of 53 ft. to the mile, and the Cascade range is passed with grades of 116, as is the case with the Great Northern. As with the two more northerly routes, the heavy grades on the Northern Pacific are so bunched that they can be operated under special arrangements, by running lighter trains or heavier locomotives, or both.

The grades of the Union Pacific are much less favorable in degree and in distribution. From Omaha to Cheyenne, 516 miles, the maximum grades west are 66 ft. and east 40; then the summit is passed in 57 miles with grades of 80 and 91 ft. For 300 miles more there are undulations all along the line with grades of 63 and 66 ft., and west of that there are 300 miles more, less broken, but still with heavy ruling grades, namely, 66 and 79 ft., after which a summit is passed with a grade of 106 ft. westbound and 90 ft. eastbound. Between Huntington and Pendleton Junction, 173 miles, is a bad piece of line with three summits and ruling grades running up to 116 ft., and from Pendleton Junction to the Pacific, 231 miles, the profile is considerably broken, there being short grades of 74 ft. and 90 ft.

The Atchison, Topeka & Santa Fé profile is the worst of all. From Kansas City to La Junta, 571 miles, the ruling grades are 63 and 61 ft. east and westbound, respectively, and even between Kansas City and Chicago the maximum grades are 58 ft. westbound and 79 eastbound. Between La Junta and Albuquerque, 348 miles, bad summits are passed with a very broken profile, the ruling grades here rising to 185 and 175 ft. Then there is a distance of 285 miles with ruling grades of 53 ft. and again a distance of 540 miles with westbound grades of 75 and 87 ft. and eastbound grades of 137 and 158 ft. Even after the Cajon summit is passed and west of San Bernardino the line does not reach tidewater without passing summits with grades of 116 ft. to the mile. As compared with any of the more northerly routes the profile is unfortunate, the sum of the grades being much greater and the profile very much more broken.

The sheet from which these profiles were reduced was compiled in the office of the Great Northern, and we are indebted to the officers of that company for the opportunity to use it. We have added the degree of longitude nearest to the main continental divide on each of the profiles, which shows in an interesting way the sweep of the divide far to the east and then again to the west, going from north to south.

TABLE OF GRADES—CANADIAN PACIFIC.

From	Elev.	To	Elev.	Miles.	Max. grade. W.	Max. grade. E.	Total ascent (approx.). W.	Total ascent (approx.). E.
Montreal	65	Winnipeg	733	1,423.6	53	53	10,787	10,119
Winnipeg	733	Medicine Hat	2,147	660.3	53	53	4,060	2,646
Medicine Hat	2,147	Donald	2,540	362.3	116	237	4,173	3,780
Donald	2,540	Revelstoke	1,453	79.9	116	116	1,938	3,025
Revelstoke	1,453	Kamloops	1,160	128.2	116	116	1,173	1,466
Kamloops	1,160	Vancouver	10	250.5	53	53	920	2,070
Montreal		Vancouver		2,904.8	116	237	23,051	23,106
Winnipeg		Vancouver		1,481.2	116	237	12,264	12,987

TABLE OF GRADES—GREAT NORTHERN.

From	Elev.	To	Elev.	Miles.	Max. grade. W.	Max. grade. E.	Total ascent (approx). W.	Total ascent (approx). E.
St. Paul	702.6	Minot	1,563	530.4	32	32	2,074 4	1,204
Minot	1,563	Pacific Junction	2,517	434.6	32	32	2,015	1,761
Pacific Junction	2,517	Kalispell	2 946	260 9	53	105	4,457	4,028
Kalispell	2,946	Spokane	1,869	251.3	79	79	2,340	3,417
Spokane	1,869	Everett	21	305.3	116	116	4,429	6,277
St. Paul		Everett		1,782.5	116	116	15,305.4	15,987

TABLE OF GRADES—NORTHERN PACIFIC.

From	Elev.	To	Elev.	Miles.	Max. grade. W.	Max. grade. E.	Total ascent. (approx.) W.	Total ascent. (approx.) E.
St. Paul	703	Glendive	2,069	666	53	53	5,459	4,093
Glendive	2,069	Livingston	4,487	341	26	26	2,668	250
Livingston	4.487	Helena	3.9 2	123	116	116	1,714	2,969
Helena	3,932	Jocko	2,509	169	116	116	2,451	3.874
Jocko	2,509	Ellensburg	1,513	485	53	53	3.459	4.455
Ellensburg	1.513	Tacoma	10	125	116	116	1,386	2,889
St. Paul		Tacoma		1,909	116	116	17,137	17,830

TABLE OF GRADES—UNION PACIFIC AND O. R. & N.

From	Elev.	To	Elev.	Miles.	Max. grade. W.	Max. grade. E.	Total ascent, (approx.) W.	Total ascent. (approx.) E.
Omaha	1,031	Cheyenne	6.050	516.3	66	40	5,312	293
Cheyenne	6,050	Laramie	7,149	56 6	80	91	2,197	1,098
Laramie	7. 49	Granger	6,279	302.6	66	63	2,302	3.172
Granger	6,279	Ticeska	3,087	357.9	66	79	1,306	4,498
Ticeska	3,087	Reverse	3,084	36.1	106	90	552	555
Reverse	3,084	Huntington	2,112	147.3	26	26	184	1,156
Huntington	2,112	Pendleton Junction	1,101	173.0	116	105	3,736	4.747
Pendleton Junction	1,101	Portland	35	231.8	74	90	850	1,916
Omaha		Portland		1,821.6	116	105	16,439	17,435

TABLE OF GRADES—ATCHISON, TOPEKA & SANTA FE.

From	Elev.	To	Elev.	Miles.	Max. grade. W.	Max. grade E.	Total ascent (approx.) W.	Total ascent (approx.) E.
Chicago	593	Kansas City	750	458	58	79	4,111	3,954
Kansas City	750	La Junta	4 061	571	63	61	5,197	1,886
La Junta	4,061	Albuquerque	4,950	348	185	175	8 440	7.551
Albuquerque	4,950	Winslow	4,848	285	53	53	2,930	3,032
Winslow	4,848	The Needles	477	290	75	137	5,307	9,678
The Needles	477	San Bernardino	1,075	250	87	158	6,163	5,565
San Bernardino	1.075	National City	10	192	116	116	1,855	2,920
Chicago		National City		2,394	185	175	34,003	34,586
Kansas City		National City		1,936			29,892	30,632

Railroad Telegraph Superintendents' Convention.

The annual convention of the Association of Railway Telegraph Superintendents was held at Milwaukee on June 20 and 21, about 30 members being present, many of them with their wives. In the absence of President L. H. Korty, Vice-President U. J. Fry presided.

An address of welcome by Governor Peck was delivered by phonograph, the Governor himself not being able to be present. The reproduction was well rendered, every one in the room being able to hear the Governor's words with great distinctness.

In this connection it will be of interest to state that the proceedings of the meetings were reported verbatim on the phonograph, two of which instruments were provided for the purpose by the North American Phonograph Company, together with an expert operator and an assistant. As the remarks of the members were uttered they were repeated into the phonograph by the operator through a speaking tube. This latter operation was done so noiselessly that no one would ever suspect that anything unusual was going on. When the cylinder of one phonograph was filled, the operator would sieze the mouthpiece of the other instrument, which had been previously made ready by the assistant, and continue his work without any break in the continuity. The first phonograph would then be prepared, and by this alternation from one instrument to the other the operator was enabled to obtain a complete report of the proceedings. The contents of each cylinder were then typewritten in the usual manner.

It was voted to hold the next annual meeting at Niagara Falls, but this action was subsequently reconsidered and Detroit substituted for Niagara Falls. The date was set for June 13, 1894.

The election of officers for the ensuing year resulted as follows: President, U. J. Fry (C., M. & St. P.); Vice-President, G. M. Dugan (I. C.); Secretary and Treasurer, P. W. Drew (Wis. Central, Chicago).

At the Wednesday morning session the Chicago & Northwestern invited any of the members who might so desire to go over any portion of its lines. Mr. S. Marsh Young, of the Hall Signal Co., invited the Association by letter to make the return trip to Chicago by the Chicago & Northwestern road, so that they might see the signals between Evanston and Chicago. A special parlor car was attached to the 11:30 a. m. train from Milwaukee, Thursday, for the accommodation of the party, and a large number accepted the invitation. The Johnson Railroad Signal Co. sent an invitation to the members to visit its exhibit at the World's Fair.

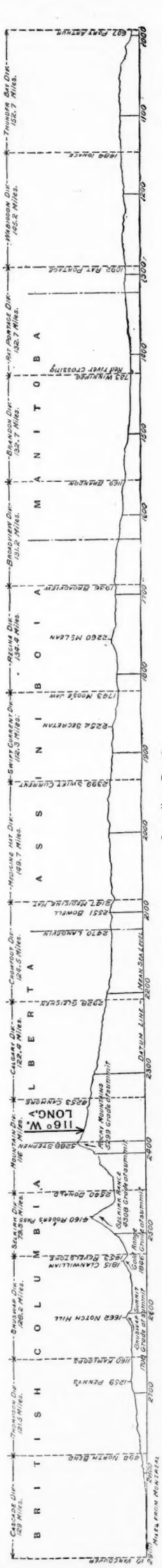
A letter from the retiring President, L. H. Korty, of the Union Pacific, was read, recommending consideration of the subject of standard signals on telegraph lines. At present every road had its own code of signals, which was necessarily confusing, and the cause of considerable annoyance and inconvenience. The President subsequently appointed a committee to take proper action in the premises.

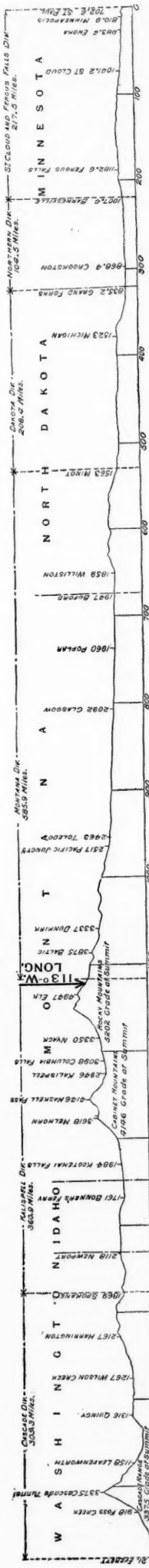
An interesting paper by Mr. Korty, entitled "The Commercial Telegraph Error Sheet," was read by Mr. Selden. Mr. Korty referred in strong language to the annoyance due to the employment of "traveling operators," but he did *not* especially emphasize the point that the only remedy for this is to lay siege to the general manager until a larger appropriation can be secured so as to pay good salaries and keep reliable operators.

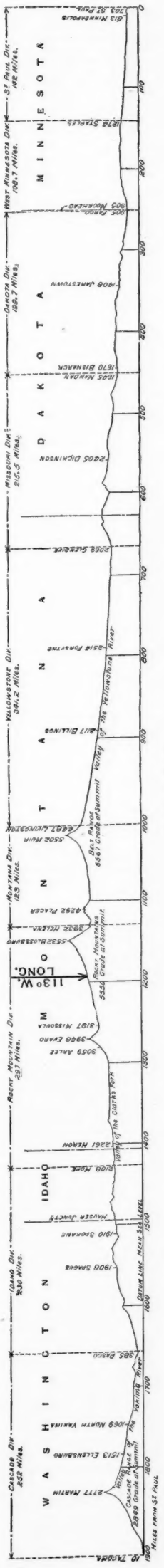
The report of the Committee on Operators' Service Cards was then read. It recommended the return of the cards to the men, instead of destroying them, as is now the practice; that they be made larger than the present size, and that they be lithographed in order to prevent counterfeiting. A long discussion ensued, which resulted in a vote directing the Committee to prepare a new form of card in accordance with its recommendations, and that the Secretary have the same printed and distributed.

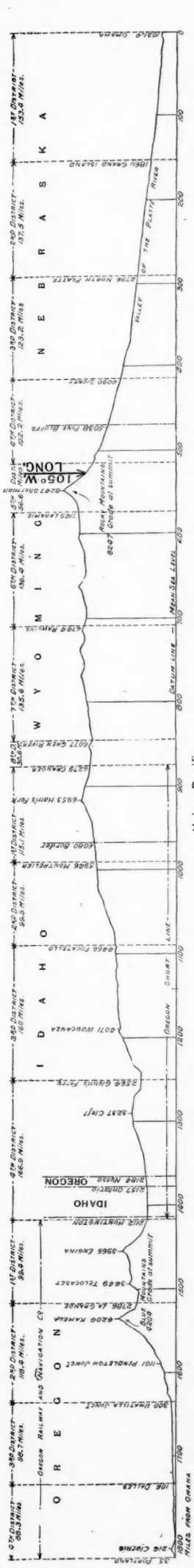
At the afternoon session Mr. G. L. Lang (New York & New England), of Boston, read a paper on "Batteries." He said, in part:

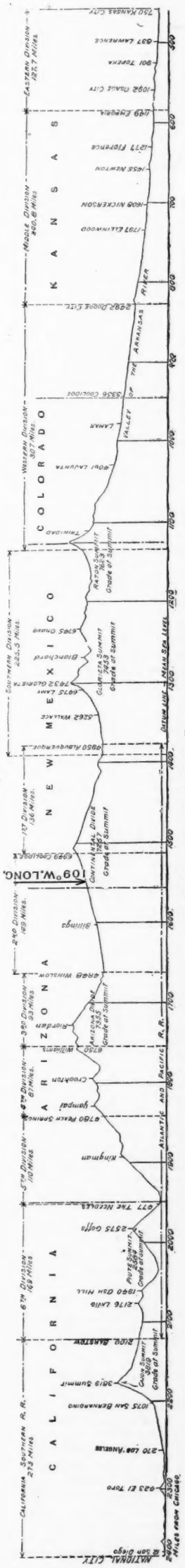
The old-time battery is rapidly passing away. Our city offices have already discarded it to a great extent.











PROFILES OF FIVE TRANS-CONTINENTAL RAILROAD LINES, SHOWING PRINCIPAL ELEVATIONS ABOVE MEAN SEA LEVEL.

The Callaud gravity battery still holds its position wherever chemical batteries are used, but the dynamo, though its early reputation was such that linemen would almost as soon go into battle as to attempt to handle wires supplied by it, has at last been so perfected as to give us a current absolutely constant under all circumstances at a very low cost. In the main office of the Postal Telegraph Company at Boston, not a cell of battery is used for any purpose, the machine currents being used even for call bells and district messenger service. The Western Union office will be ready in a few weeks to banish its last gravity cell. Machine currents can now be adapted to our locals just as economically as to main wires.

But as we must continue to depend upon the Callaud battery for our country locals a few words regarding its care may not be out of place. Too much vitriol is usually put into a cell at a time. Half a pound is sufficient in starting a cell, then add a few ounces as required. Supply every office with a hydrometer and battery syringe. When the hydrometer shows the zinc solution to be too dense, draw it off and fill up carefully with water. In this way a battery can be made to last for months. The usual custom is to dump the whole cell whenever it gives out, wasting valuable material. The quality of the water used is quite important, soft water being the best; but where good water cannot be readily obtained it will be found of great advantage to wrap the zinc in thin cotton cloth. The impurities of the water collect upon the cloth instead of on the zinc, adding greatly to the life of the battery. If possible keep your battery at an even temperature, from 50 to 60 degrees. Our early teaching was that a battery must be kept in a dry place. Theoretically this is all right, but in my signal work I have found that we get the very best results when the battery is under ground and where there is more or less dampness. I do not argue from this that the dampness is a benefit to the battery, but I do claim that moderate moisture is far less detrimental than the frequent and extreme changes of temperature which are inevitable when batteries are kept above the ground simply to keep them dry. Under ground there is no creeping of the solution over the jar always found elsewhere, and practically no evaporation.

Mr. Thos. D. Lockwood, of the Bell Telephone Company, Boston, who is an honorary member of the Association, spoke of the practical application of dynamo currents to telephony, and gave some valuable advice regarding the care of batteries.

He then read a paper entitled "Energy," which abounded in good points. The superintendent, who is a true embodiment of the best form of energy, said he, knows all his men, and not only knows, but knows well those who have been with him a long time. Moreover, he knows them with such "energy" as to have sized up their relative capacities, fitness for promotion, and general merit, and in making promotions is not governed by impulse or personal preference. He advised the railroad telegraph superintendent not to expend his energy either in himself inventing or becoming concerned in the electrical inventions of others; he should be absolutely unbiased. The ideal superintendent, he thought, was the one who has plant, force and records in such perfect order that he could absolutely disappear for six months and yet "never be missed."

An interesting discussion followed the reading of this paper, relating chiefly to the question of making joints in hard drawn copper wire, which is now so extensively used for telegraph lines.

A paper on "Introduction of Telegraph Wires Into Offices" was read by E. R. Adams, of the Philadelphia & Reading, who gave some valuable hints. The paper provoked an interesting discussion. Secretary Drew then gave a historical sketch of the Association, which was organized in Chicago on Nov. 20, 1882, and briefly reviewed the work of that and each of the subsequent meetings down to the present time. The Association now has 100 members, connected with 75 railroads, with headquarters in 31 different states.

Mr. J. W. Lattig, of the National Switch and Signal Company, read a paper on railroad signaling and its relation to the telegraph department. Among other things he said:

This term "signal" I use in its broadest sense, including the telegraph, which, after all, is merely a system of signaling. It is true that it is a system of signaling of an infinitely higher order than the mere placing of a semaphore in a certain position; still it is a system of signaling, and certainly the leading and most important branch of signaling on railroads. With an organized department to care for the most important and dangerous class of signaling, does it not seem strange that at additional expense there should be created on many roads another department to care for a branch of signaling of an inferior order? We are fast receding from the days of purely mechanical signaling and as rapidly approaching the day of electrical signaling, a method requiring the talent already employed in the telegraph department. Several eminent signal engineers look upon the field of electrical railroad signaling with great favor, and only regret that they are not fitted to handle the subject with the same familiarity and knowledge with which they have been accustomed to handle the mechanical methods. All the leading signal companies are now offering automatic signals, either worked entirely by electrical means or which, if worked by other means, are governed electrically. I could produce testimony from several lines where the signal department, mechanical and electrical, is under the telegraph head, and is giving most satisfactory results. I could also add the evidence of other superintendents of telegraph who have recognized the tendency of matters, and are preparing and fitting themselves and their departments for the discharge of such new responsibilities against the day when they will certainly come. I also know of another road where there is a constant conflict between the signal and telegraph departments, which I am certain will sooner or later resolve itself in favor of the telegraph, the bone of contention being the signal tower operators. These are some of the reasons why we are, or ought to be, interested in the subject of signaling; and, if not fitted individually or in our departments to take charge of the enlarged field, we should at once begin to prepare for the day when the general manager desires to abolish and consolidate the signal department with the telegraph.

Mr. Lattig then went on to formulate the elementary requirements of railroad signals, among which he mentioned the following: (a) The natural and unfailing law of gravity should always be relied upon to place the signal at danger. (b) The crossing, breaking or grounding of a signal wire of any kind should place the signal at danger. (c) Rubbing electrical contacts should be insisted upon wherever possible, on the score of reliability. (d) No rubbing contact can be relied upon which, when closed, joins two metallic surfaces, and which, when open, allows one of such surfaces to pass to or over or rest upon an insulating surface, such as hard rubber; they are always unreliable. I have even known electric motors to fall off materially in power, due to this cause. (e) No contact should be used that permits or is subject to rapid oxidation. It will be a source of unending failures and trials. I have in mind an apparatus sold by a certain signal company to a certain railroad company, over the electrical signals and appliances of which I had charge at the time, which was so defective in this respect that a pair of platinum contacts would not last over two weeks, and even iridium would burn out and fail in from three weeks to a month. The device, promising to cost more for contacts than it saved by replacing a watchman, was finally abandoned for a less "improved" device, which is still working. (f) Every appliance of this character should be critically examined to see whether it is liable to failure from expansion and contraction due to changes in temperature, or if the changes and conditions of weather are liable to affect it, and how. (g) It should be substantially made, and not so delicate as to be interfered with by accumulations of dust, gummed oil or rust, and have a reasonably high percentage of power for its operation over and above that required to operate it.

EXHIBITS.

The National Switch & Signal Co. exhibited Lattig's automatic semaphore. This semaphore was described in the *Railroad Gazette*, Dec. 30 last.

Mr. J. B. Stewart, of the West Shore, showed a model of an automatic signal devised by him for use at grade crossings of one railroad with another. The apparatus is not only automatic, but has connected with it a clock and apparatus for recording the time of each operation.

Mr. U. J. Fry, of the Chicago, Milwaukee & St. Paul, showed an automatic repeater of the Toye type adapted by himself to certain special needs of his road.

Mr. C. Selden, of the Baltimore & Ohio, showed a working model of a highway crossing bell invented by H. V. Riley, of Baltimore.

The Mozier Safety Signal Co. exhibited its three-position semaphore.

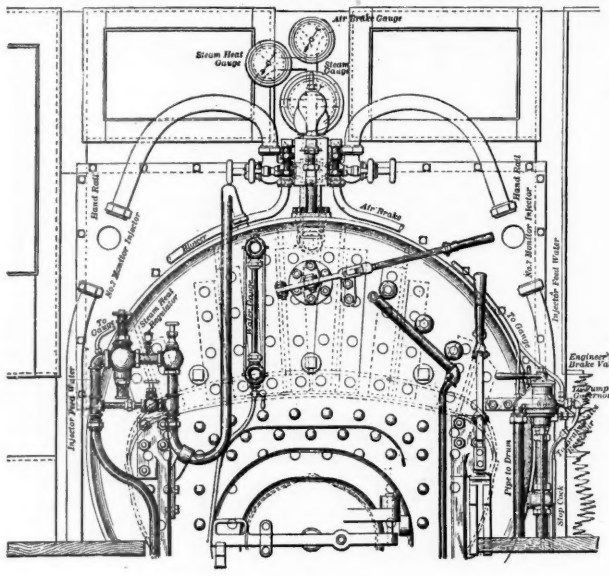


Fig. 1.

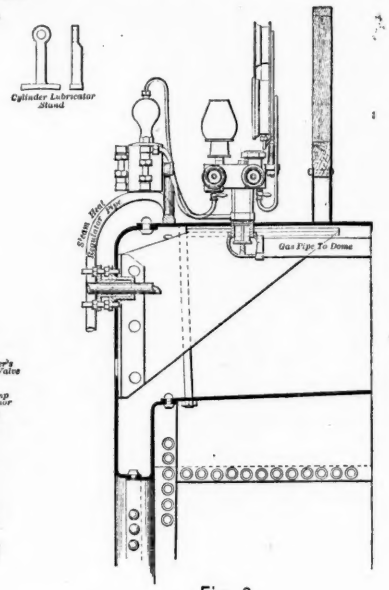


Fig. 2.

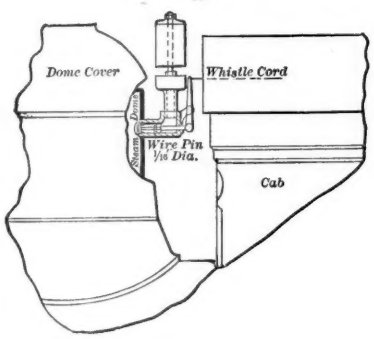


Fig. 6.

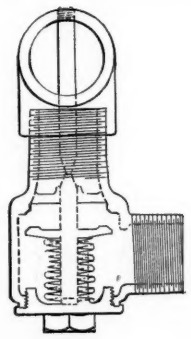


Fig. 4.

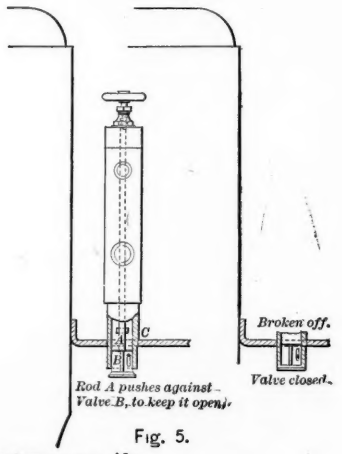


Fig. 5.

With Report of M. M. Committee on Boiler Attachments.

Master Mechanics' Convention.

[*Continued from page* 469.]

REPORT ON BOILER ATTACHMENTS.

Your committee, considering the importance of their subject, issued circulars embodying the following six questions:

1st. Give a list of the parts attached to your standard locomotive boiler, which, if broken off in case of accident, would leave opening in boiler.

2d. How could the number of openings in boiler for such attachments be diminished?

3d. In what way could such openings be protected to prevent the escape of hot water or steam in case attachments are accidentally broken?

4th. What is the best method of connecting check valves to boilers—flange joint, or screwed direct into boiler? Give size of connection that should be used. Have you had any experience with inside check valves, and what is your opinion of their safety and efficiency, compared with outside checks?

5th. Do you think it necessary or advisable to use water glasses in addition to gauge? What size do you use? Is it advisable to use an automatic valve in water-glass cocks to prevent the blowing of steam and hot water in case of water glass breaking?

6th. Is it your practice to use a steam chamber to connect blower, injector valves, steam-heating valves, etc., or is it your practice to connect these attachments separately to boiler? Is there any provision made to close the connection between steam chamber and boiler?

While your committee have been favored with a sufficient number of replies to give them an idea of the practice in vogue by a greater percentage of the largest railroad systems, still the replies were not as complete as might be expected on a subject of such importance, involving the safety of passengers, as well as employés. many of the more important questions have been evaded in the replies; others have indefinitely explained their practice, and some have given a very full and complete explanation.

The committee submit below a tabulated statement, giving in a condensed form the replies received, which, in the estimation of the committee, represents as nearly as can be the methods and manners in which boiler attachments are applied to boilers by different companies.

Question No. 1:
E. T., V. & G. report least number of openings.
Average number of openings reported, 11.
Question No. 2:
8 Give no suggestions as to how the number of openings could be reduced.
1 Favors both injectors on one side.
1 Recommends abolishing some of the attachments.
11 Favor use of steam chamber.
2 Favor use of steam chamber and water column for gauge cock.
Question No. 3:
6 Claim the escape of water and steam could be prevented by use of inside valves.
7 By use of automatic valves.
9 Give no opinion.
1 Claims attachments are too light.
Question No. 4:
9 No experience with inside checks.
3 Now experimenting.
3 No answer.
3 Experience favorable.
2 Experience unfavorable.
3 No experience, but favor same.
Question No. 5:
14 Think water-glass necessary.
9 Think water-glass unnecessary.
7 Think automatic valves necessary to protect water-gauge cock.
9 No answer.
5 Do not consider automatic valves necessary.
1 Prefer shield for protection.
Question No. 6:
18 Use steam-chamber.
4 Attach parts separately.
1 Uses turrets.
8 Have no provision to close connection.
4 Use ordinary valves.
5 Use automatic valves.
6 No answer.

From the foregoing, coupled with their own experience and observation, the committee havt decided on the following recommendations, which, in their opinion, are consistent, and will establish a greater degree of uniformity and safety in boiler attachments.

1st. All connections for conveying steam from boiler, excepting gauge-cocks, water-gauge glasses, check-valves, blow-off cocks, service cocks, whistle and safety valves, be attached to the steam chamber, connected to boiler by a flange, to be bolted to the top of boiler, or to the back side of dome, and that a self-closing or automatic valve be used inside of boiler or below a point where the connections with the boiler are liable to be broken, and a valve be placed between chambe

and boiler. Illustrations of good practice in this respect are shown in figs. 1 and 2.

2d. A gauge-cock with guard-valve inside of boiler is quite desirable, but not knowing of any form of such cocks, which is entirely satisfactory, we refrain from recommending any.

3d. Water-gauge glasses are not a necessity, while same may be a convenience to engineers and firemen, and that when same are used they should be supplied with automatic closing valves.

4th. The check valves be attached by flanges to the back boiler-head, and the feed-water be conducted to the front end of boiler by a pipe or trough inside of the boiler, or when the connection of check-valves to boiler cannot consistently be made to the back boiler-head, that a double check-valve might be attached to the back side of dome, and the water conveyed from this to the front end of boiler by a pipe or open trough, and that only one opening be made in boiler for connecting the check-valves, this opening to be protected by a guard-valve inside, and a double "T" pipe with two check-valves, one for each injector, be provided outside. See figs. 4 and 5.

5th. That blow-off cocks be placed in the front or back ends of fireboxes and not on either side.

6th. That all studs screwed into boiler be made with a weakening groove outside.

7th. That the whistle valves be placed inside of the boiler, and, if not, that a separate guard-valve be provided. See fig. 6.

8th. That safety-valves be placed in a recess in dome cover below the top of dome, so as to be protected from injury in case of collision or other accident.

In addition, the committee wish to direct attention to the fact that the majority of the railroads are now using steam chambers in one form or another; that while it would be difficult to design a steam chamber for the uniform adoption of all railroads and to meet the views of all members it should not require much argument to convince every member of the Association of the necessity of having the steam chamber, be it of what style it may, as long as it embodies the necessary features of safety.

The committee are also of the opinion that there is a tendency of making attachments too light, and that a much greater degree of safety could be established by making attachments more substantial. There is also a great tendency of applying unnecessary attachments to boilers, which could readily be abandoned entirely.

The committee have recommended the use of flange joint in the application of checks, this being almost universally adopted already, and it no doubt being the most substantial manner of application, less apt to be broken off, and safer in every way than the screw joint.

Committee, { JAMES MACBETH. A. DOLBEER. J. M. BOON. W. A. FOSTER. M. N. FORNEY.

DISCUSSION OF REPORT ON BOILER ATTACHMENTS.

Mr. SINCLAIR: The committee express the opinion that gauge water glasses are not a necessity. In modern locomotive running they have been considered a necessity, and are so regarded on nearly all roads nowadays.

It is not only a convenience to engineers and firemen, but it is a means of better regulation of the water supply than can be done with the ordinary gauge cocks, and therefore the most advanced men in this line consider the water glass a necessity.

Mr. D. L. BARNES: I would like to subscribe to what Mr. Sinclair says. We had 25 engines come on to the elevated railroad in Chicago without water glasses. We had three burnt crown sheets right away, and on examining the men before the board we found that they claimed that the gauge cocks had an unusual sound. The board, being of a semi-scientific practical character, said that if a man could not tell by the sound of the gauge cocks for a dead certainty where the water was he ought not to be discharged, these being small boilers, while the men were accustomed to large boilers. Therefore we could not reprimand the men as we wanted to, but we had to put on water glasses.

MR. HENDERSON: On the Norfolk & Western several years ago it was decided to omit the gauge glasses entirely. That was followed by a number of crown sheets coming down. After that we put on two glass tubes, one where the fireman could observe it, and since then there has been comparatively little trouble.

Mr. MCBETH: It was not the intention of the committee to recommend doing away with water glasses. The water glass is a good thing if it is taken care of. If it is not taken care of it is a very dangerous article. That has been decided by the courts.

MR. SPRAGUE: It would be taking a step backward to remove the water glasses. The engineer ought to have every chance to watch the water in his boiler. When I was on a railroad I found that the glasses we used would stand about so long, and I found by changing them in a certain length of time—I think six months—that I hardly ever had one break on the road. I changed them regularly at that time, whether they broke or not.

Mr. Mackintosh, Mr. Small, Mr. Mitchell and Mr. William Smith spoke also in favor of the water glass.

Mr. CLARK: I do not think this Association should put itself on record that it is absolutely necessary to have a water glass put on a locomotive. I attended a law suit recently in Buffalo where an engine had exploded, killing the engineer and fireman. The case was that there was no water glass and no fusible plug in the firebox. A number of master mechanics were there from different roads, to testify, and it was finally decided that the water glasses were not necessary. If we put ourself on record that the water glass is absolutely necessary there will be some suits based upon that.

Mr. R. C. BLACKALL: I have been connected with the road I am now on for 30 years; we have in the neighborhood of 400 locomotives, and during all that time we have used no water glasses and I cannot see the necessity for them.

Mr. SETCHEL: We ought not to put ourselves on record as saying that it was impossible to run a locomotive without water glasses. I have run a locomotive for a great many years without water glasses, and there are a great many roads that will not use them at all. But to say that they are not a convenience and an additional safeguard to the engineer, I think would also be a mistake. They are a safeguard, and if the engineer will only take care of his water glass and his gauge cocks he will have double protection for the prevention of low water. On a great many locomotives that are being built now the firemen is removed from the engineer and it is a great help in firing the engine for the fireman to have a water glass. I do not know but that a good water glass will enable the fireman, if he pays strict attention, to save pretty nearly as much fuel as a compound engine.

Mr. MITCHELL: I would like to ask if any one is using check valves on the back boiler heads carrying a trough inside the boiler to the front end?

Mr. FOSTER: My check valves are not on the back end. They are on the shell of the boiler, about as close up as you can get to a wagon-top boiler. I have one running that has a trough about 8 ft. long. The check valve is on top of the boiler—double check. It is working very well indeed. My idea was to have the water as hot as possible when it came in contact with the flue.

Mr. BLACKWELL: I think that it is the universal practice on the London & Northwestern Railway of England to put the checks on the back head. I noticed in Chicago that on the engine exhibited by the Canadian Pacific road the checks were on the back head.

Mr. JOHN MACKENZIE: I have had engines in which the crown sheet dropped that had glass gauges, and I have had the crown sheets drop on engines that did not have glass gauges. . . . The great trouble with glass gauges, in my opinion, is that they are not fitted properly. Instead of using a five-eighth glass, we ought to use a three-quarter glass, and the connection to the boiler should be enlarged so that you absolutely always have a free and open connection at both points, top and bottom. As to the foaming of the engines, I was connected with a railroad at one time that had some water about as vile as a man would want to put into a boiler, and I have sat on the engines and seen the boilers foam. Whenever it began to foam they would reach over and shut the glass gauge and run with the smokestack and gauge cock. I believe that that is the way to handle an engine that foams.

Mr. LEWIS: I have handled engines on roads where it was all the engine could do to make a run of 200 miles and be able to haul a train at all. As soon as the engine was working to its full capacity it would throw a spray of water out of the stack. The moment the throttle was shut off the water went out of sight. The water gauge is not only a safeguard against the burning of the engine but it enables the engineer to work an engine to better advantage. . . . I would very much dislike to have this Association take the stand that the water glass is not necessary, because I think there are localities where it is an absolute necessity.

Mr. SETCHEL: I offer the following resolution:

"Resolved, That while the Master Mechanics' Association regard the water glass as a convenience and an additional precaution against low water we do not regard it as an absolute necessity to the safe running of locomotives."

Mr. GILLIS: We have two water glasses on most of our engines, one for the fireman and one for the engineer, and it struck me at first that it was a little unnecessary to have those two glasses; but I was told that it was very necessary to have two glasses; so that in case anything should happen—if the firemen should be hurt—you would have some excuse, that he had a gauge which he could see; he was not dependent on the engineer at all. I took that as all right. I investigated the thing a little further. I did not find a single water-glass on 40 engines which I examined on the fireman's end of the boiler that were in working order. They were all stopped up. Most of them had the glass broken. I found that some of the firemen talked very forcibly about that glass. They didn't want it there, they said; they might be shoveling coal into the furnace and the glass might break, and they would be scalded. I have no objection to the water-glass, but I don't think we want too many of them on the engine. I think it would be a good idea for a master mechanic to find out just how many of his water-glasses are operating, especially if he has bad water.

Mr. LEWIS: In regard to the statement made by Mr. Gillis that he had found on 40 engines nearly all the water glasses inoperative does not seem to me to be anything against the water glass. That is a question of discipline on the part of the officers who are responsible for it. I find no difficulty in keeping the water glasses in proper working order. In the examination of our men before promotion we question them about the water glass and we explain to them the necessity of noticing the water in the glass to determine whether or not the cocks are obstructed and that it is an important matter at all times to observe the motion of the water in the tank. I am satisfied that I can get better results from an engine with the water glass than I can from the guage cocks.

MR. SPRAGUE: I would like to say one word in regard to the legal aspect of the thing. It has raised in my mind the question whether we are here to give our best judgment as to what is proper and safe for locomotive practice, or whether we are here to evade legal obligations—whether we are here to advance the interests of the locomotive or whether we are here to whip the devil around a stump and avoid lawsuits. I do not think that ought to be taken into consideration. If we are satisfied that a thing is an advantage to the locomotive, we ought to advocate it regardless of lawsuits.

Mr. Setchel's resolution was adopted.

DISCUSSION ON STANDARD TESTS FOR LOCOMOTIVES.

Mr. WILLIAM FORSYTH: Mr. President, we have occupied more than an hour this morniag in talking on water glasses. I hope you will have patience with me for about fifteen or twenty minutes or less in talking about this report on tests of locomotives. I will ask you then to listen to a short account of what the committee of the mechanical engineers and your committee have done on this subject. In 1890 the Mechanical Engineers' Society appointed a committee on standard method of testing locomotives, composed of Mr. Dean, Mr. Cloud, Mr. Vogt, Mr. Stirling, Mr. Denton, Mr. Soule and myself. That committee made a report in 1892, and this report which was presented to you is a revision of the report by Mr. Dean and Mr. Lauder. In 1892 Mr. Barnes, Mr. Barrus and Professor Goss were added to the Mechanical Engineers' committee. The report of the Mechanical Engineers' Society was presented as a preliminary one, and since that, a few weeks ago, it was revised at the Chicago meeting, and Mr. Dean, who was present at that meeting, agreed that his report which was then in the hands of the Secretary of the Association would also need revision, and for that reason, when the report came up yesterday or Monday, he was quite willing that it also be presented as a preliminary report. Now, the most important thing which we have added to the engineers' report is the section on shop tests, of which I would like to read a synopsis.

Shop Tests.

Shop tests are recommended, and their necessity is urged, because of the facility, when once provision is made for them, with which they may be conducted, the accurate methods of observation which they permit, and the means they furnish for investigating elements in locomotive performance which cannot be satisfactorily developed on the road. Shop tests will not make road tests unnecessary, for it is by the combination of both forms that the fullest information can be obtained; but it is evident that where such a combination is employed many of the determinations made in the testing shed will apply to the condition of the road, and that the road tests may, as a consequence, be much simplified.

In stationary practice, the necessity for constant conditions during a test which is to serve any purpose beyond that of simply giving the power of the engine, has long been recognized. . . . These recognized principles governing all experimental study of the action of stationary engines, have for obvious reasons, been difficult to apply in testing locomotives. A standard train, use of the same line, and adherence to schedule time, all as recommended in the preceding pages of this report, will do much for road tests, in this direction. But when all precautions have been taken there still remain conditions which are variable in character, the effect of which must be reduced by repeated runs.

The necessity for test work of a high order is emphasized by the fact that the real difference in the economy of different well designed locomotives of the same size when employed in similar service is not great. This fact appears to remain true even when both simple and compound engines are included in the comparison. If the steam engineering problem involved could be worked out by tests which would leave no doubt as to what these differences are under the best possible conditions, locomotive designers would have a much more definite starting point than at present, and the science of locomotive engineering would be materially advanced. It is from such considerations as these that the value of shop testing becomes most apparent. The ease with which, in such tests, the same conditions can be maintained throughout a run, and the certainty with which these same conditions may be duplicated from day to day are important factors in their favor. . . . The most complete arrangement thus far proposed is that developed by Prof ssor Goss for the Engineering Laboratory of Purdue University. [The description of this arrangement has been published several times and therefore is omitted here.—EDITOR.]

For the purpose of inspecting this plant and of witnessing a test a meeting of the committee was called at Lafayette on Feb. 23, 1893. On that occasion the engine was run for two hours at a speed of 24 miles while developing 453 H. P. The brakes absorbed the power without the slightest difficulty. After running half an hour the oil circulating through the middle compartment of brakes had assumed a temperature easily borne by the hand, and no further increase of temperature occurred during the run of two hours. The trial might have continued apparently for an indefinite period without any disturbance of the uniformity of the conditions. The fore and aft vibration of the engine, at 24 miles an hour, was less than a tenth of an inch. The point of the cow-catcher vibrated laterally with an easy motion through about three eighths of an inch. No other movement of the engine was visible. The drawbar strain was so steady that the weighing-lever was easily kept poised between the steps. After the above trial the engine was run at about 50 miles per hour for about fifteen minutes. The vibration at the drawbar was considerably increased at the higher speed. A more perfect balancing of the engine has been accomplished since the meeting; this vibration has been reduced to an amount that is insignificant, even for speeds considerably above 50 miles per hour. This being accomplished, your committee believes that there are few elements in the performance of locomotives which cannot be determined by laboratory arrangements such as are at Purdue University, with greater accuracy and far less expenditure of time, than by attempting measurements of engines upon a railroad.

In concluding this portion of the report your committee would summarize the points of advantage to be gained by the adopting of the plan of shop testing as follows:

1. It insures constancy of conditions.
2. It makes whole parts of the whole plant readily accessible and permits the application of accessory apparatus of every sort.
3. It increases the possible accuracy with which observations may be taken.
4. It affords exceptional opportunities for investigating the action of the mechanism when under speed.
5. It is comparatively inexpensive.

Now in defense of this methad of testing I will say that I am very glad that I have had an opportunity to read this after the discussion on compound engines yesterday, for I think that that very discussion and the report of the committee emphasize the fast that road tests of engines are not sufficiently accurate to determine these fine engineering points which come into tests of compound and simple engines, and as a practical thing I will read a recommendation of Professor Denton who is a member of the mechanical engineers' committee:

STEVENS INSTITUTE OF TECHNOLOGY.
HOBOKEN, N. J., June 3, 1893.

Wm. Forsyth, Esq.: I suggest the following thought as a basis for some possible action of the committee in regard to

the application of our standard code for a series of laboratory tests:

The attempts to measure the relative economy of compound and simple locomotives thus far made, I believe, makes the situation about as follows:

Mr. Barrus found about 10 per cent. greater economy for a Vauclain compound than for a simple engine in freight service and none in passenger service. The Milwaukee tests indicated about the same results. The C., B. & Q. tests show upward of 20 per cent. greater economy for simple passenger than for a Vauclain compound. Hudson's tests of two-cylinder compounds indicate upward of 20 per cent. superior economy for the compound than for the simple engines for both passenger and freight service. Dean's tests of two-cylinder compounds indicate upward of 30 per cent. greater economy than single engines for passenger service.

The results in each case are accepted as reliable, or as settling the question of the relative superiority of economy of the compound versus the simple engine, by only the particular parties most directly concerned in each particular case, and very little headway appears to have been made toward any general agreement on the subject.

I believe that tests of economy in road service will continue to be indefinite to the extent of at least 15 per cent., and that, therefore, if a few standard engines could be taken to a testing plant like that at Purdue University, and their performance recorded under a series of cut-offs and speeds, the opinions of all interested in the relative economy of the two types of engines would be made to agree to a greater extent in a few months than will be the case in as many years without such an investigation.

The apparatus which Professor Goss has perfected puts the success of such an investigation beyond reasonable doubt. If it was removed from his laboratory and set up in an isolated building at Purdue, the funds placed at Professor Goss' disposal, under the direction of a joint committee from the Mechanical Engineers' and Master Mechanics' associations, a half dozen or more selected engines could be successfully sent there, and tested at intervals of, say, six weeks, without interfering with the instruction exercises of his laboratory, as would be the case, I presume, with his apparatus as now located. An investigation of this character would, I believe, yield results of sufficient practical importance to railroads to warrant their subscription to a fund of, say, $15,000 for its consummation. This fund would cover the cost of an inexpensive building, with a small stationary boiler for driving a fan, and heating, for coal, for the services of a corps of assistants of Professor Goss' selection, and some salary for the latter's services in directing the work.

Would it not, therefore, be well for our committee, and the Master Mechanics' committee, to recommend the appointment of a new joint committee to arrange with the authorities of Purdue University in regard to their co-operation for carrying out such an investigation, and to solicit subscriptions from leading railroads for the purpose? Yours truly,

(Signed) J. E. DENTON.

Now the Mechanical Engineers' Society are ready to go into this thing and I have brought it before you this morning to see if you are.

Mr. HENDERSON: I think that is a matter of great interest to all of us and of great importance and I certainly hope that we shall take some action that will look forward to bringing about the result which Mr. Forsyth has explained. I would like heartily to indorse this idea and would urge its advancement, and whatever steps we do take I hope will be taken in a very hearty manner and follow up the suggestion of the American Society of Mechanical Engineers.

Mr. MITCHELL: I think all of us agree that shop tests should be made between simple and compound engines. Therefore I would make this resolution:

Resolved, That the Committee on Locomotive Tests be instructed to co-operate with the committee from the Mechanical Engineers' Society in a series of comparative shop tests of compound and simple locomotives to be made on the locomotive testing apparatus of Purdue University; second, that the Executive Committee be instructed to provide funds to pay the necessary expenses connected with such shop tests and solicit subscriptions for this account from railroad companies and locomotive builders.

Mr. D. L. BARNES: I have never been an enthusiast for shop tests, believing that there are many things that cannot be settled in a shop, but there are a great many other things that cannot be settled on the road. For instance, no one knows how to set the valve for a compound locomotive, so far as I know, to get the best results. No one knows how large to make the receiver, or the proper ratio between the cylinders of high and low pressure. The two-cylinder compound locomotives are giving lots of trouble for the lack of that knowledge, and four-cylinder locomotives are giving a lot of trouble because the valves are not properly arranged. We have not yet seen, as I said the other day, an indicator card from a compound locomotive at 60 miles an hour that is a credit to the engine or that is as good as a card taken from a simple engine at the same speed. It has been asked whether it is economical to run a locomotive with the throttle partly closed or wide open. That question was settled by the Purdue University tests last year. They tried that test, wiredrawing from 140 to 180 pounds. As had been predicted before, the wiredrawing produced superheating. The superheating was as much as 25 degrees, but the economy fell off immediately. The loss of potential, or the lots of possibility of doing work by loosing pressure due to wiredrawing, makes a loss of 20 per cent. in the efficiency of the engine. Such a question as that is very much better settled in the laboratory.

Then, again, in regard to counterbalancing. We have never known, as far as I am aware, just what to do. This Schenectady engine was built with great care. They are known to make very well counterbalanced engines. But she would not run in the laboratory. At 55 miles an hour she got dangerous to the apparatus. With the pointer on the engine you could see right away what the trouble was. They put on more counterbalance and the engine worked very satisfactorily. The temperature of the smokebox is another thing we want to know more about. The thermometers we have used are wholly unsatisfactory. They vary as much as 200 deg. when put in the same smokebox and under the same conditions. At the University they use a copper ball which they put in next to the flues. They know the weight of the copper ball. They drop it in water when it comes out, and in that way they get a record of the temperature.

Another interesting thing they found down there was the lifting of the drivers due to the counterbalance. I got down under the machine—it is very accessible—and I could see in between the drivers and the carrier wheel when the counterbalances were up. But, to settle that question, they fed a wire around between the two wheels, and first found that the wire was flattened down when the counterbalance was down. When the counterbalance was up the wire passed through. These are only a few questions that can be settled in the laboratory that can not be settled on the road.

Mr. Mitchell's resolution was carried.

REPORT ON ATTACHMENTS BETWEEN ENGINE AND TENDER, ETC.

The tenor of the replies to your committee's circular clearly shows that our members think the risk to enginemen is small from tender either mounting or running under engine foot-plate, in fact is "nil" if the chafing-plates and their backing are in line and the coupling-bar is horizontal, lying close up to casting. In locating the coupling-bar even better practice is to put it the vertical centre of the chafing-plates, so that the bar has to suffer a straight shear before tender can start to mount engine foot-plate. Therefore, in the matter of coupling, we indorse the correctness and safety of the practice common in America of coupling engine and tender together, provided the chafing-plates have liberal surface, are of equal height, have ample straight backing (if possible in a single casting), and stout horizontal wrought iron drawbar with cottered coupling pins of large diameter is used.

Safety couplings should be used to supplement the coupling-bar, and with two exceptions the replies favor stout chain in short links as better than side coupling-bars. If solid side bars are used one end should have an oval or slotted hole, so that there shall be no tendency to bind when on curves. The securing of the ends of the safety chains is in many cases of a most flimsy character. The best sent us is from D., S. S. & A. R., both chains being permanently held to the tender beam by double ended staple bolts of 1¼ in. round iron, the loose ends being coupled to the underside of engine draw casting by two pair of pendent lugs cast on, through which (and through last link of chain) passes a 1¼-in. horizontal cottered bolt.

There is apparently no uniformity in the shape of chafing surfaces, some making both surfaces flat, others make one flat and one round, and the P. & R. use both rounded, each to a radius struck from the centre of its coupling pin. This insures contact when the vehicles are either on curve or tangent without that pinching and bending which is responsible for some of the undesirable lengthening of the coupling bar.

Half of the members repiying use a wedge to take up the slack in bar and the wear in chafing-plates, and it is to be inferred from the limited information given that they use a horizontal wedge, requiring for adjustment the labor of separating the engine from the tender and then coupling up again, as no reply gives any experience with patented or other vertical wedges that take up the slack automatically, that is, take it up by gravity. One reports using an eccentric bush on coupling-pin, to vary the length of coupling-bar. Apart from use of wedge and eccentric, no form of taking up wear and slack is mentioned, other than the old-fashioned practice of taking out the coupling-bar and getting it upset by a smith.

No difficulty or increased resistance in backing around a sharp curve has been noticed with any width or shape of chafing surface, if the gangway or platform of tender is properly curved so that it does not foul engine when on sharp curve. It is so difficult to believe that some such resistance does not exist that we were at first inclined to indorse the P. & R. plan of rounding both chafing surfaces to curves struck from centre of draw-pins, as this results in the coupling pins being exactly the same distance apart, independent of the relative positions of engine and tender; but one member of this committee, with special experience in propelling trains, tender first, around curves, says, if the chafing surfaces are rounded to any short radius the pressure tends to derail the tender or turn the rail over, and always causes excessive wear on the journal collars of the tender axles. He now uses a flat plate on engine, 8×20 in. long, and this length is used to prevent tender chafing-face slipping by the ends and locking, as did occur when a shorter flat plate was used. The tender surface is 8×10 in. long, curved to a radius struck from centre of forward tender truck. If other conditions make it advisable to curve the engine chafing surface, he would do it to a radius struck from centre of rear driving axle.

The L. & N. W. Ry. and the P. R. R. use a spring buffer coupling arrangement on new work, and the N. & W. R. think such a plan has advantages. The main drawbar, like the side couplings, has clearance at one end to allow for free play of spring in compression, as well as freedom in curving. A fair inference from practice permitting so elastic and flexible a connection is, that its users and indorsers do not consider there is any risk to men on foot plate that justifies a closer interlocking arrangement. Probably the intention in using a buffer coupling now—as in the early days of the locomotive—is to increase the comfort of the passengers, as well as to lessen sudden shocks on metal, and the strains tending to rack tender frame.

Committee, { J. DAVIS BARNETT, G. W. STEVENS, C. E. SMART, J. W. HILL.

DISCUSSION ON ATTACHMENTS BETWEEN ENGINE AND TENDER.

Mr. J. DAVIS BARNETT: Very emphatic as are the statements of the committee, they embody the opinions of only 23 members of this Association. A majority of the replies as received came in the form of blueprints, and the committee had to analyze and dimension the blueprints and work the information in the best way they could from that source. I may say that in the matter of drawbars, for instance, there is some very bad practice on this continent, if one were to accept the blueprints as representing the actual shop and road practice. . . . There are cases of very light safety couplings, and I noticed in one engine at the Columbian Exposition, a powerful engine at that, where the safety chains are 1⅜ of an inch in diameter—just one-third the cross section area of that which the committee recommends. . . . If the blueprints are to be believed, the hook usually fastened to the tender securing the free end of the coupling chains is in many cases shown with the sharpest possible corner where it bends around a right-angled turn. It seems to me no earthly use if you are running and the coupling bar should break; you might as well have left all such fixings off.

In the matter of steps I see no reason wey steps should be put up so very high, except it be to clear snow and other obstructions, and it seems to me that is a very poor reason to give, so that they might save a dollar a year, and I do think that exposes men to very great risk in jumping on engines when they are in movement. I think it would be better, even if we did lose such an occasional step, that we put that step so low down as to lessen that risk. Bearing all this in mind when walking through the Columbian Exposition and noticing an engine said to have been designed by men running the engine I thought I would pay some little attention to these points nnd see if an engine designed by men handling engines was any safer at these points than an engine designed by a master mechanic. I found as soon as I stepped upon the foot plate that the brake wheel I could just get the top of my nose on to. The ratchet and pawl to be worked by the foot to hold that brake beam from slipping back was 14½ in. above foot-plate level. The depth of the horseshoe in the tender was the greatest depth in any tender I have seen for several years, there being no slope either at the back or side to throw fuel well forward to the front. The steps were simply secured by a single set screw, by no means the safest form of securing a step and the hand rail and foot steps in the neighborhood of the head lamp to be used by the men when lighting up were far from being the safest and most convenient that I have seen.

Mr. MITCHELL: In the engine referred to by Mr. Barnett, which the engineers built, I think the design of the parts that he referred to was by the builder. The railroad company with which these engineers were connected had nothing whatever to do with the design in any detail, and in talking with some of the committee of the engineers I inferred from what they said that they only specified the principal parts, like the size of cylinders, size of boiler, journal, and such details as that. I think these minor details referred to are for the builders.

Mr. GILLIS: I think in justice to the builder it should also be said that, as I understand, the engineers who designed this engine had inspectors to overlook the construction and see that it was done as they desired.

Mr. MCKENZIE: I was very much interested in the remarks made by Mr. Barnett as to the designing of that engine. It would seem to me that if a committee of engineers were to design an engine they would look particularly after the parts that they were to handle, and which they knew something about and would let other parts that they knew nothing about alone. It seems that they lost sight of the fact that they did not know anything about the boiler or cylinder or anything of that kind, and they went to work and designed those parts of the engine, and when they came to the brake wheel, as Mr. Barnett says, they put it where they could not get to it without a step-ladder.

Mr. GILLIS: In regard to the clause in the report which says: "There are a few who believe that there is more risk to men in case of an accident from the tank moving forward on tender frame, but no suggestions are made to improve the present mode of securing tank." I would say that we do believe on the Norfolk & Western that there is danger from that very cause. We know that there are a number of cases where men have been hurt from the tender sliding forward on the frame, and a design has recently been completed to prevent that. Mr. Henderson might give us some information as to that design.

Mr. HENDERSON: Some time ago I prepared a sketch showing a couple of lugs, such as Mr. Barnett speaks of, extending below the bottom of the tank and secured by strong iron rods to the rear bolster. This was with the wooden frame. We are now getting up a steel frame and we expect that the bottom of the tank back of the coal space will have a heavy angle iron riveted on wide enough to come between the two centre channels, and the angle will be 6 in. × 4 in., provided with two rows of rivets and letting this project down below the top of the frame. Then there will be plates of iron across the top of the frame so that this angle will project below it, and it will be almost impossible for the tank to slide up on that frame without ripping the bottom out of the tank.

Mr. TANDY: In order to lessen the liability to injure engineers and firemen we have lately adopted what we think is a unique tender step. We have abandoned the step usually put on the engine and have made a step out of one casting which we attach on the front end of the tender frame. The first riser is about 20 in. in length and placed 15 in. above the rail level. The second riser is placed midway between the first riser and the tender flooring, and the entire thing is securely bolted to the front end of the channel frame, and the bottom riser, I might mention, is carried forward so that it reaches underneath the tail end of the engine, and we think it is not necessary to put a step on the engine at all, because if you give a man two steps he thinks that is all he has to use, and if you put one on the engine he thinks he has got to use it if it takes the bark off his shin.

REPORT ON SMOKE PREVENTION.

Smoke prevention means perfect combustion. The matter of perfect combustion has been discussed, and

the principles upon which it depends have been thoroughly established long before the existence of this Association. . . . We find in practice that the ordinary locomotive with deep firebox, equipped with a fire-brick arch and ten 2-in. combustion tubes, three on each side of the box and two on each end, can be operated practically with no smoke while running. It is understood that the locomotive is fired carefully, the fuel being introduced in small quantities so as not to lower the temperature of the incandescent body of fuel. . . .

This, however, is not the case when the locomotive is at a standstill. . . . The matter of smoke prevention, therefore, involves the provision of additional means to meet the requirements of locomotives when at rest and when starting into action. Numerous devices have been arranged for this purpose, the essential basis of all consisting in means for injecting air over the surface of the fire, and any of these devices which furnish air in sufficient quantity over the surface of the fire, the temperature of the fire being properly maintained, will prevent the formation of smoke. Devices of this kind have been in use for at least 50 years. The difficulty in the use of such devices occurs when the temperature of the mass of burning fuel becomes too low. In such cases the device will not prevent smoke; and frequently, by assisting in lowering the temperature of the ignited fuel, will rather foster the formation of smoke than prevent it.

If the temperature of the firebox begins to fall below the point at which smoke can be prevented, the difficulty may be avoided by turning on the blower and thus increasing the heat of the firebox. The objection to this practice is its tendency to increase the formation of steam in the boiler and consequent blowing off at the safety valves.

It will be readily seen that smoke prevention involves not only the proper arrangement of the firebox, but very considerable care and attention on the part of the engineer and fireman. When the locomotive is running, the special manipulation, which is necessary on the part of the enginemen, is to introduce fuel in small quantities so as not to perceptibly decrease the temperature of the incandescent bed of fuel in the firebox. When a locomotive is at rest there is considerable more manipulation required, dependent on the length of time the locomotive remains in that condition. If it is to remain at rest for some time the engineer should prepare for it by allowing water to run low in the boiler; the fireman should prepare for it by seeing that the firebox contains a considerable amount of fuel in a state of full incandescence. If, with the locomotive in this condition, the period of inaction is so long that the temperature of the firebox falls below the point at which smoke is produced, the conditions are such that the engineer can turn on the blower for some time in order to maintain the proper temperature in the firebox, and at the same time prevent blowing off by putting the injector in operation and gradually filling the boiler. The fireman can also, if necessary, introduce a small quantity of fuel without producing smoke; and by putting in operation the apparatus for injecting air over the surface of the fire, the formation of smoke can be prevented for quite a length of time, the locomotive, during this time, being maintained in condition for doing full service.

There seems to be an impression that a smoke consumer, or more properly a smoke preventer, can be made which will prevent smoke when put in operation, irrespective of the conditions mentioned above, but this is not the case. If, however, the conditions mentioned above as to proper temperature in the firebox are maintained, any of the numerous devices for consuming smoke which introduce a proper quantity of air into the firebox over the surface of the fuel, will be efficient.

A number of smoke consumers are in use in the neighborhood of Chicago. They all operate on the same principle of injecting air over the surface of the fire, and all are quite efficient if the proper conditions are maintained in the firebox; none are efficient if such conditions are not maintained. The roads centring in Chicago use, among others, the Walker smoke consumer, the Barnes, the Western, and a number of others which are slight modifications of those mentioned. The essential point in the Walker smoke consumer is an arrangement by which injection of air occurs automatically when the throttle lever is closed, or when the firedoor is opened to introduce a fresh supply of fuel. The essential point in the Barnes device consists in the addition of a blower in the smokestack which goes into operation simultaneously with the injection of air into the firebox. The other devices consist to a great extent in modifications of the steam and air nozzles in order to secure greater efficiency in the injection of air and in the prevention of the very unpleasant noise which occurs when the devices are put in operation. The avoidance of noise in these devices is of very considerable importance, and especially so in switch engines. J. N. BARR.

DISCUSSION OF REPORT ON SMOKE PREVENTION.

Mr. MITCHELL: I had an opportunity several years ago to make a test of what is known as the Hutchinson smoke-burning device. The engine was provided with a brick arch, and in making a test of something like two months' duration we found we were burning more coal with the smoke-burning device than we did without it, thereby demonstrating to our satisfaction that in place of burning the smoke and producing more perfect combustion we burnt more coal and mixed the steam with the smoke, thereby causing the black color. In my judgment in a perfect smoke-burning device the air admitted must be heated to the same temperature as the gases before admission in order to burn the smoke, and the temperature of the gases, or, in other words, the temperature of the incoming air must at least be about 800 degrees to permit the oxygen to mix with the hydrocarbon gases in order to produce that combustion. With the French furnace, with which I was connected at one time, we had a hollow brick arch. We admitted the air through six or eight 3 in. hollow flues. The air passing through the brick arch became heated to the temperature of the arch and when the air was admitted to the firebox it mingled with the gases coming off the fire and gave us a very perfect combustion of the gases and reduced the black smoke to a very great extent. That device, however, was a failure, for several reasons, the principal being that the arch would not stand up with the intense heat, and again where the arch would work successfully with good coal, with poor coal the arch would melt right down.

Mr. MARSHALL: I am very much convinced that the best smoke preventer any of us ever saw is a good fireman. You can put any device on the locomotive that you please and if the fireman does not attend to business the locomotive will smoke. . . .

There is another thing in connection with the grates that ought to receive attention. On a number of roads it has been found that a grate pattern which was all right at one time, as far as air spaces were concerned, had gradually thickened up because the fingers broke or the bars failed in some way, and without very much attention being attached to the subject the air spaces were very much reduced, and I have no doubt but what there were many of these grate bars giving very much less air space through them than the master mechanic thinks.

Regarding hot air, the necessity for heating air to be mingled with the gases above the fire, I am of the opinion that most devices that attempt that are impracticable, and it does not seem to me necessary to heat the air.

Mr. LEEDS: I was at Dunkirk yesterday and among other things that I took note of and purposed to try was what I considered a first-class smoke consumer, and that was nothing more nor less than a grate bar which struck me as being just about correct.

Several years ago we tried the introduction of tubes from the back end of the firebox through two 4 in. openings on each side of the door just below this pipe passing up below the arch of the door and down on each side of the firebox and under the brick arch. Those pipes were drilled full of holes of about three-sixteenths. and of course the pipe being red hot all the while the air that passed into it was heated to a great extent before passing over the fire, and decidedly it came the nearest to being a smoke consumer of anything that I ever saw. We ran it for several months, burned out a great many sets of pipes during the time and never saved a pound of coal that we could any of us find.

Mr. WILLIAM SMITH: We have got about 200 engines now with smoke-burning devices of one kind or another. We keep them more for necessity than choice, very largely on the jet principle order. But the best device that I have tried for reducing smoke in general, although it is not satisfactory around cities, is this—we have got a shield about 18 in. long. That is placed inside the firebox just over the furnace door. You run a brick arch and the brick arch and shield are about 18 in. apart. The furnace door is as far up as you can get it. We have a slot cut about 9 or 10 in. long and 1¾ in. deep. Then we have a little damper there and we run with the damper up, and in firing that we put the damper in. The air has to pass down this shield and comes into the fire between the brick arch and the shield. The air, in passing below this shield. gets heated up pretty hot, and the only trouble we find is the burning out of this shield. They will last one to two months; some will last three months. We turn up a flange on this shield about 2½ or 3 in. But, if that shield could be made to stand, it seems to me it is about the best smoke-preventing device that I know of—that is, for road service and the comfort of passengers.

Mr. MCINTOSH: All our engines operated in Chicago are equipped with smoke preventers, known as the Barnes device. The special feature of this is the heating of the air before it is injected into the box; another is that it is practically noiseless. We went into the matter very carefully, and considered this about the best that was in the market. An engine equipped with the brick arch and circulating tubes will not smoke to any great extent—that is to say, we can meet the requirements of the corporation if the engineer and fireman are alive to their duties, Following in this line I have adopted a plan that may be of benefit to those that have to operate engines in Chicago, or such places. I have adopted the practice of requiring the engineer to answer the question, Yes or No, on his time slips, which he makes out daily, whether he violated the smoke ordinance—of course they know what constitutes a violation—during that trip or in the time covered by the slip. I am pleased to say that we have never been called into the courts as yet; that is the only check that you can have against the inspectors who are watching you. If an engineer is called into the courts in three weeks or a month after the violation is alleged to have occurred the chances are that he will remember nothing, and is to no value to you as a witness. We take his time slip, which bears his signature and hold him entirely responsible. If the engineer should report a violation we immediately get after it and find out the cause, and in that way we get on to many little defects that we would not otherwise, until the inspectors caught us,

Mr. MITCHELL: I would like to ask Mr. Smith and Mr. McIntosh if by their smoke-burning devices they have effected any saving in coal?

Mr. SMITH: All the smoke-burning device I have tried have been a waste in fuel with the exception of this one. I have got so tired of hearing about the saving of fuel that I have never made any experiments with this device, but the firemen in general tell me it is a saving. I know it is a saving on the flues and I know there are a number of men that beg to have it and would not be without it.

TOPICAL DISCUSSION.

"What is the best method of handling locomotive boilers when washing out is required and the proper method to be pursued in the examination of stay bolts?" handed up by Mr. John MacKenzie.

Mr. MACKENZIE: We came to the conclusion that the proper time to test staybolts is immediately after the water has been blown from the boiler, while the temperature is high and while the steam is left in the boiler. Our method is to blow the water from the boiler out through the blow-off cock; then close the blow-off cock and run the engine into the roundhouse and allow the engine to stand there until an examination is made of the staybolts. Then turn the blow-off cock and let the steam and water pass out gradually. We allow one hour after the water leaves the boiler before we begin washing out. So far as we have been able to determine we think it is a pretty good plan.

Mr. GENTRY: I would like to get the views of some of the members who have yard masters and train dispatchers after them for engines. We are limited in power and are very much pressed, and of course we have to stop to wash our boilers. It is a right that we reserve. We do not pay any attention to these people who are hammering at us to get them. But we have that difficulty to contend with, and if there are any methods of successfully dealing with this matter we want to get at them. If I can get any information I would like to have it, and afterwards I will try to tell you how we undertake to do it.

Mr. MCINTOSH: In regard to staybolts, my opinion is that the best arrangement for detecting broken staybolts is to drill those that are most liable to break—drill the outer ends or use a hollow bolt.

As regards washing out boilers under the condition mentioned by Mr. MacKenzie and Mr. Gentry, it is my experience that this can best be accomplished by filling the boiler. In the first place, blow off the steam and then fill the boiler. When this is accomplished open the blow-off cock sufficiently to allow the same quantity of water to run out as is going in. In this manner you cool your boiler off uniformly. All portions of it will have a like temperature. Continue this process until you have reduced the temperature to such a point that you can place your hand on the boiler, or nearly to that point, and then let the water all out and proceed to wash out. You can reduce the temperature in this manner in from 30 to 45 minutes and the washing out can be accomplished very quickly afterwards. We do the washing out with hot water and also fill the boiler again with hot water.

Mr. ARP: The practice at the Denison shops in regard to washing out is to attach a hose to the feed pipe and then allow the water, the hot water or steam, to pass out through the blow-off cock, holding the water at the third or fourth gage cock, as the case may be, until the boiler becomes cold enough to lay your hand on. Then we let the water out and proceed with our washing out. It takes us an hour and thirty minutes to an hour and forty-five minutes.

In answer to the question that Mr. Gentry put, I would say that when we get an engine in the roundhouse we consider that the dispatcher has nothing to do with it until we say it is ready.

Mr. LEEDS: I would say that my practice for several years, and my instructions, since I have given up the direct care of locomotives, correspond exactly with what this gentleman has said. I found that by filling through the injector throttles we could change the temperature of the water very fast and bring the boiler down to its lowest expansion without any injury to it. But I always did insist, in filling the boiler, that the throttles should be closed, for the very reason that our dry pipe running into the dome, if it is over the crown sheet, introduces the water directly on to the crown sheet, and if there was any difference in the temperature of the water and of the crown sheet, it caused a contraction there that I did not care about having; and if the dome was forward of the wagon-top, as it is in the Belpaire boiler, then it was spreading itself over the flues a great deal worse than it would through the jets. That is the only difference I have made in my practice from what this gentleman has just said. I have never had any trouble with weak flues, cracked fireboxes or anything of the kind, and it seems to me I have handled engines very expeditiously in that way.

Mr. ARP: Some of the members may think that it would take a long time to get the steam on the engine with cold water. But we have a steam pipe running through our roundhouse, to which we have an attachment that we can attach to the boiler, and we can get steam on the engine with cold water, so that we can move her out of the roundhouse in 20 minutes after being washed out.

Mr. LEEDS: I have always taken exception to that way of firing up an engine. I would a great deal rather heat my water before it is put into the boiler, and that is the reason I do not like to introduce hot water even onto a cold crown sheet or to a cold flue. . . . I would rather take that same amount of steam and introduce it directly into my boiler, which I do.

Mr. GENTRY: We do not have any necessity for using cold water at all because we use a very heavy steam boiler washer and our method is very much like Mr. Mackenzie's and Mr. Leeds. In fact, I find it to be a very common one and prevails, I suppose, in every well regulated engine house, or should. Our practice is in hurrying our engines out—our pits are all culverted to a very large culvert and the blow cocks of the engine are all fitted with the standard screw thread. We simply couple on a pipe rather larger than the blow cock. We immediately blow the steam out, and after turning on

the stopcock a little our boiler washers connect it up with the feed pipe. We immediately commence to fill the engine with water of probably a little lower temperature than that we are letting out, and as I have explained before our water is of such a nature that we have very little scale to contend with. After the boiler has been reduced so that the temperature is down beyond the drying point of scale and silt we simply run all the water out there and finish the washing of the boiler with this hot water.

There is one little thing we have that is not generally adopted in engine-houses, and that is we simply extend our steam pipe that we use in filling the engines up back about as far as the air pump is situated on our engines, and there we have a piece of steam, hose, and our air-brake inspector has the advantage of testing everything while the engine has steam off, if he wants to. We have had trouble with some passenger engines once or twice through not being able to make a proper test until we had steam. We found some defect just about when the engine was ready to take the train out and we had to change the pump. The members will find this arrangement of running their air pumps a very good one.

The PRESIDENT: The question of the examination of staybolts has not been touched upon.

Mr. MACKENZIE: I was just going to call attention to that and particularly the method of blowing the water from the boiler. We blow the water entirely from the boiler and soon after the engine arrives at its terminal point it is brought to the place where it is supposed to be blown off. We try to get as much steam on the boiler as possible before we clean the fire and then blow the water until it leaves the blow-off cock; close the blow-off cock and run the engine into the round house and let her stand there at least one hour. We find from that practice that the vaporizing of the steam that is in the boiler and the gradual cooling off softens the mud on the crown sheet, and our boiler washers tell me that very much less scale comes from the boiler than was formerly the case. Another thing about testing staybolts, we think that with the water out of the boiler and the boiler being warm, any expansion at all between the shell of the boiler and the firebox would naturally bring the staybolts apart, and if there is a particle of space between there the sound would be brought to you. If the water is there you cannot detect the sound. That is what we claim, and for that reason we follow the practice of testing the staybolts without water but with steam in the boiler.

Mr. BROWN: Our method of trying staybolts is something similar to what is described by the gentleman. We would rather test the staybolt without water, and we would like to do it as soon as possible after the water has gone out, and we do it every time the fire is out, whether it is once a week or once in two weeks, or when we wash it out once a month. Every time the fire is out a man goes in and sounds the staybolts, and if he finds any broken he will report it.

Mr. GENTRY: Does Mr. Brown test his staybolts without any pressure on the boiler?

Mr. BROWN: Yes, sir. The man goes in immediately after the water has gone out. He does not wait until she cools off. It is very seldom that he misses any. I do not know that a bolt is ever broken but what we find it when we put the hammer on. As I say, if it is one staybolt here or there that we think we can let go we might do so, but if there is a couple of them, why out they come, and we take the jacket off and sound the whole of them then.

Mr. GENTRY: I believe where the best practice prevails and the most success is obtained in locating broken stay-bolts they test the flues with pressure on the boiler. We do that. We have an idea that, by expanding the sheet with pressure, if there is a broken bolt we will get the sheet forced sufficiently away from the contact with the bolt to locate it better even than with the hammer test. It is our practice to test our bolts as often as we can. Mr. Brown says that they wash their boilers about once in a month or five weeks. We wash our boilers every round trip. We never think of allowing a consolidation engine or a ten-wheel engine to go longer than that. Our freight engines run from Richmond to Atlanta, Ga., 560 miles in one direction and back. That is a round trip with those engines. We of course wash the engines every time they make a round trip. The passenger engines' run is shorter, and we wash them about every two trips.

Mr. MITCHELL: There is a great deal of difference, I find, in our practice in locating broken staybolts. We had occasion to make a test the other day. We had to remove a firebox from a locomotive. That locomotive was sent to the shop, and a sketch was made of every staybolt in the boiler and the exact location. Then the inspectors from that territory covering all the shops were sent to this point, and they were asked to sound those staybolts, and give the man who had charge of the drawing every broken staybolt in the boiler. After all the inspectors had sounded the staybolts from that boiler and had located every broken staybolt, the firebox was cut out and every broken staybolt exactly located and a correct drawing made and a comparison made between each individnal inspection, and the accurate statement showing the exact location of the broken staybolts. We found a great variation in the broken staybolts discovered by the inspectors. We also found that all the inspectors, I think, without exception, called some sound staybolts broken. It showed the need of educating our inspectors to be more careful in this work. That was done with the boiler cold.

Mr. LEWIS: Mr. Mackenzie was of the opinion that blowing the water out of the boiler and leaving a portion of steam on the boiler had a tendency to soften up the scale. My practice has convinced me that by filling the boiler with water while it yet has steam on and cooling it quite gradually, as described by some of the gentlemen, less scale is deposited in that way than it is where you blow the water out of the boiler entirely and allow the boiler to remain empty. We start off with, say, 50 or 60 lbs. of steam on the engine. We have a steam pump with 80 to 100 lbs. cumulative pressure, and we can force the water into the boiler until it is absolutely cool, and the cooling of all parts of the boiler takes place uniformly. I think it is usually the best practice to cool an engine in that way, and when once cooled I do not see that it makes much difference whether the engine is washed with warm water or cold water.

In the matter of staybolt inspection . . . we are dependent upon the judgment and skill of men who are not always competent to judge of these questions, and, as Mr. Mitchell explained where he collected all the inspectors within a certain range on his road and conducted this test, there is a great variation in the judgment of the men as to the bolts that were broken and the bolts that were not broken. I think that the move made by Mr. Mitchell was a very good one and if it is practised by all roads it would be a great benefit.

Mr. GILLIS: One of our superintendents of motive power, Mr. Standerson, has just made extensive experiments in regard to testing staybolts, spending two or three months altogether making a study of the matter with inspectors, and in every way he could. The conclusion he reached would substantiate what Mr. Mackenzie said, I think, that the test with a slight steam pressure for the staybolts is the best test.

Mr. LEEDS: We stop all our lag above the top row of staybolts on both sides the entire length of the outside of the firebox, and at the base of that we rivet on a strip of iron with small quarter-inch studs, and from that down we have a sheet continuing the jacket from running board both into the cab and outside, and by taking off a few nuts on each side we can take these sheets off. We can hold on the dolly bar at any time without moving any of the rest of our jacket.

Mr. MCINTOSH: I failed to hear any of the members speak of experience with drilled bolts. It is my impression that in the ordinary methods of testing the bolts we are depending entirely too much on the skill of the inspector. One inspector may be well qualified in that respect and another quite indifferently qualified, and the results obtained would of course correspond with the skill of the respective inspectors. I know from a long experience with the custom of drilling bolts that if followed up it will produce absolute results.

Mr. T. B. PURVES, Jr.: Our method of washing boilers is similar to that followed by Mr. Leeds and some of the other members, and so far I am happy to say that we have not a staybolt on our line but what is drilled. Our method of inspection is very simple indeed. We know a staybolt leaks and we take it out. That is all there is to it. Every three months the jackets are removed and every staybolt exposed. I do not mean to say that we remove staybolts only once in three months. Our locomotive inspector in the engine house during his inspection, if he sees a little crust forming over the end of the bolt he reports it to our foreman boiler maker. The engine then is fired up, perhaps, ready to go out. Our foreman boiler inspector looks at it, locates it and the engine is ordered to come in and dump the following trip.

Mr. FORSYTH: Our practice corresponds with what has just been described in drilling staybolts on the outside. We have entirely abandoned the regular inspection of the staybolts on engines in service.

REPORT ON TENDER-FRAMES.

The following interrogatory circular was issued:

1st. What is your preference, iron or wood, for tender-frames?

2d. Have you adopted a standard tender-frame of wood or iron?

3d. With iron tender-frames, how long have they been in service, and have you experienced any difficulty with rivets becoming loose?

4th. What is your preference for material in tanks—iron or steel?

5th. What is the capacity in gallons of your standard tank?

6th. Please give a description or blueprint of your standard tender-truck, and state whether you use centre and side bearings on both trucks?

7th. What is the size of your standard axle and journal for tender-trucks?

8th. What material do you prefer for axles, and what are your reasons for the preference?

Any further information pertinent to these questions is respectfully solicited.

To the circular sent out we have received thirty-nine replies.

Eighteen have preference for wood, eighteen for iron, and three have no choice. The eighteen preferring wood represent 35,398 miles and 5,738 locomotives. The eighteen preferring iron represent 22,023 miles and 5,571 locomotives. The three having no choice represent 5,447 miles and 1,217 locomotives.

Of the number preferring wood, seven have had no experience with iron, three have used iron and had no serious difficulty, two say they are very expensive to maintain, one does not like them, and one thinks a good iron frame can be made. The following roads have adopted it as a standard, and give us cost of construction, as follows:

Delaware, Lackawanna & Western, Scranton, Pa.	$225.00
Baltimore & Ohio	190.50
Union Pacific R. R.	185.00
Pennsylvania R. R.	160.00
Delaware & Hudson	150.00
Wisconsin Central	145.00
Canadian Pacific	115.00
Illinois Central	101.77
Chicago, Rock Island & Pacific	92.00
Pennsylvania & Northwestern	89.00
Ohio & Mississippi	68.00
Philadelphia, Wilmington & Baltimore	32.33

Of the eighteen who prefer iron tender frames, thirteen have adopted it as a standard, one is using wood, and four do not answer the question. The cost of construction is given by only four, and is as follows:

New York, Lake Erie & Western	$365.00
Boston & Albany	280.00
Lake Shore & Michigan Southern	204.52
Delaware, Lackawanna & Western, Kingsland, N. J.	200.00

In answer to question No. 3, one gives length of service as 16 years, four as 12 years, two as 11 years, one as 10 years, one as 8 years, three as 7 years and two as 6 years. Five say: "Have had no trouble whatever with loose rivets." One says: "Seven years and never had a loose rivet." Another says: "Been in use 11 years and to-day are as good as new." Two say: "No difficulty whatever when riveting is properly done." Another says: "No serious trouble with loose rivets." Four say: "Some trouble with loose rivets, but not to any extent." Five do not answer the question.

In answer to question No. 4, twenty-seven use steel and two use iron for tanks, with capacity ranging from 3,000 to 4,000 gallons. Six do not answer the question. The Chicago, Milwaukee & St. Paul, and the Delaware & Hudson report having trouble with steel for tanks, as it deteriorates more rapidly in coal space than does iron.

Thirteen are using steel and seventeen are using iron for tender-axles. Nine do not make any reply. Twenty-four are using a diamond truck. Four are using the square iron truck. One is using the Fox pressed-steel truck, and ten do not answer the question.

Twenty are using centre bearings on forward truck, and centre and side bearings on rear truck. Nine are using centre and side bearings on both trucks. Three are using only side bearings on both trucks. Two are using only centre bearings on both trucks. Two are using only centre bearings on forward and side bearings on rear trucks.

Regarding the preference of material for tender frames the "honors are about even," and as there is a difference of opinion with the committee, we have deemed it advisable to recommend both the wood and iron tender-frame to the convention for their consideration, and respectfully call your attention to blueprints herewith presented. We desire, however, to make favorable mention of the standard iron frame of the New York, Lake Erie & Western, Boston & Albany, Lake Shore & Michigan Southern and the Boston & Maine, and for wood frames the Delaware, Lackawanna & Western, Chicago, Milwaukee & St. Paul and Union Pacific, all of which show excellent design and construction.

Committee { R. C. BLACKALL, JOHN MACKENZIE, E. E. DAVIS, THOS. PURVES, JR., F. B. MILES.

DISCUSSION OF REPORT ON TENDER FRAMES.

Mr. GENTRY: I was rather surprised to see that our Mr. Wade had not contributed any print or any information on this subject, as he prides himself on an iron tender frame that he is using. I understood him to say that he was going to communicate with Mr. Blackall.

Mr. BLACKALL: The blueprints we received would fill a good-sized flour barrel. We turned them all over to our secretary.

Mr. GENTRY: If you received ours, I suppose you would have mentioned it. I see it is not mentioned. We commenced with an iron tender frame, built by various locomotive builders, about ten years ago, and they were the most miserable things we ever tried to contend with, and we were driven some seven years ago to design one for ourselves. We now have a very heavy steel tender frame which we think is a good one. I am sorry to see that the committee did not get a chance to consider it. We do not make any difference between a tender frame for a passenger engine and for a freight engine. We use just the same thing.

REPORT ON MALLEABLE IRON CASTINGS.

Your committee have reached the conclusion that there is no evidence to indicate probability that malleable iron castings can be generally used as a substitute for expensive forgings. Malleable iron castings, as now used in connection with locomotive construction, are principally either substitutes for gray iron castings or for small and inexpensive forgings. The committee have not reached a single suggestion that malleable iron can be economically introduced in place of the larger and more expensive forgings which are now used in locomotive construction.

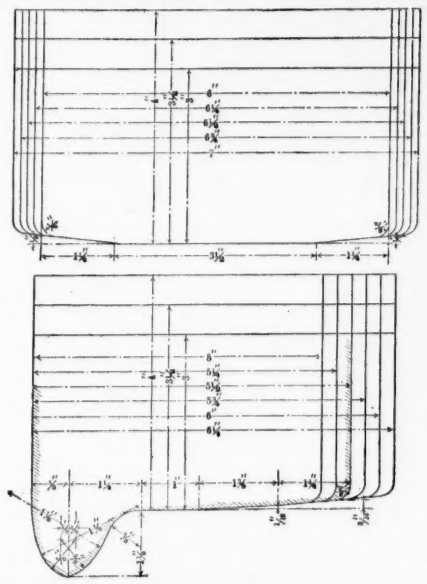
Committee, { R. H. SOULE, WM. GARSTANG, W. H. THOMAS, C. H. CORY, W. D. CROSMAN.

WHEEL CENTRES AND WHEEL TIRES.

After thoroughly canvassing this subject we find a majority of the roads recommend that the diameters of the wheel centres larger than our present standards increase by 4 ins., making the standards above the present 70, 74, 78, 82, 86 and 90 ins. in diameter.

In investigating the subject of uniformity of rolled outlines, nearly all of the roads advised the committee that they had no suggestions to offer; the subject, however, is a very important one, and should have our careful consideration. We must all agree that if a uniformity in rolled outlines of tires were to become general practice, a large saving would be effected both to the manufacturer and to the consumer. To the manufacturer, on account of their entire output being rolled to one contour, so far as the tread is concerned, thereby requiring the carrying of less stock to supply the demands, the maintenance of fewer sections of rolls, and an incentive to roll the outside so accurately that machining in shops will not be required. To the consumer, on account of being able to order tires for prompt delivery, thereby enabling them to carry much

less stock as well as saving interest on the money which otherwise would have to be invested. Every Master Mechanic, therefore, should take whatever steps are necessary to lead to the adoption of the Master Mechanics' standard outline of tire on his road, and after it has been adopted, see that every requisition



passing through or emanating from his office specifies the Master Mechanics' outline of tire and that all his gauges for shop use are made exactly to the standard outline.

In our judgment additional widths to the Master Mechanics' standard flange tire and a new standard plain tire of several widths should be adopted, and after careful consideration we would recommend the outlines shown in the engraving.

Committee { A. E. MITCHELL, W. C. ENNIS, THOS. MILLEN, C. A. THOMPSON, L. R. POMEROY.

Messrs. Mitchell, Barnett and Purvis were appointed a committee on subjects to report a list at the next convention.

The old committee submitted the following for the next convention:

1. What method of construction can be devised to prevent the cracking of the back tube sheet?
2. Devices to facilitate the oiling of fast passenger engines when on long continuous runs; and effective cylinder lubrication with high-pressure steam?
3. The value of locomotive fire kindlers and their relation to fire insurance risk?
4. Exhaust nozzles and steam passages.
5. Standard specifications and tests for boilers and firebox steel to be recommended for adoption by this Association.
6. Modern sanding devices.
7. Special shop tools, either hand, power, pneumatic or electric, applied or applicable to locomotive manufacture and repair.
8. The recommendation of a uniform system of examination and test of boilers in actual service, more especially for the discovery of broken stay bolts.
9. Fire treatment—what is the amount of shrinkage to be allowed for large driving wheels? Is there any necessity for tire-retaining rugs or clips? What is the limit of thickness that various diameters of tires should be worn down to before being scrapped? What is the greatest allowable depth of groove worn in tread before tire should be turned up in lathe?

WM. SMITH, Chairman.

On motion the by-laws were changed so as to provide that the regular meeting of the Association should be held annually on the Monday after the second Tuesday in June.

The following officers were elected:

President, Mr. John Hickey; First Vice-President, Mr. William Garstang; Second Vice-President, Mr. R. C. Blackall; Treasurer, Mr. O. Stewart; Secretary, Mr. Angus Sinclair.

The following places were named by different members in response to a request from the President for suggestions as to the place for the next annual meeting: St. Paul, St. Louis, Saratoga, Old Point Comfort.

CONVENTION NOTES.

The Brooks Locomotive Works entertained the Master Mechanics' Association on Tuesday, an afternoon meeting of that body having been held on Monday in order to enable the members to visit the Brooks' shops without interfering with the routine work. Transportation was furnished by the Western New York & Pennsylvania, and a special train was run to Dunkirk.

At Dunkirk the party were conducted to the works, where the ladies were received by the wives and friends of the officers of the Brooks Locomotive Works, and the gentlemen were shown through all departments of the plant.

The shops were in full running shape and there are many improvements not generally found in locomotive shops. There are unusually complete tools in the boiler shops, and every department has been put into good modern shape. Few of the visitors had understood before what a large and complete concern the Brooks Locomotive Works really is. The workmanship and finish are equal to any other shop in the country, and the durability of the engines, which depends upon good material and good hardening, is well known to be high. The drafting room and laboratories are complete, and in this the Brooks Works stands at the head in this country. The technical school in connection with these works, which we have described before, is of a high order, as has often been referred to in foreign reports on technical schools as an example of the duty of manufacturers to their employés.

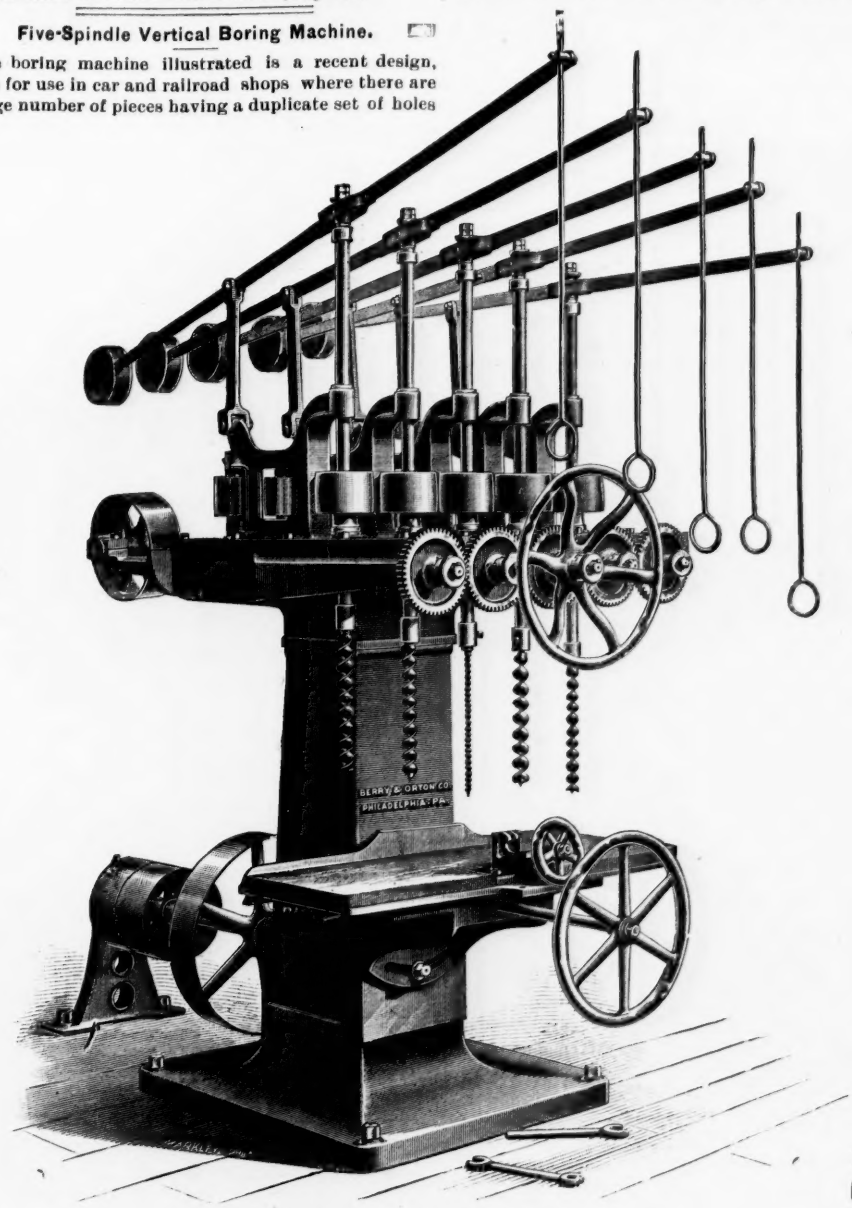
After the visits to the works an elaborate luncheon was served in the technical school room.

On invitation of A. E. Mitchell, Superintendent of Motive Power, New York, Lake Erie & Western Railroad, and Messrs. Sibley & Miller, of the Galena Oil Works, a special train load of Master Car Builders, Master Mechanics, and their friends made a trip on Saturday to Meadville, Franklin, Titusville and Oil City. At Meadville the party visited the driving park. At Franklin, the party was conveyed by carriages to Prospect Hill stock farm, where luncheon was served in two large tents in the woods. Messrs. A. W. Waitt, T. A. Bissell, John Hickey, G. W. West, and R. C. Blackall made brief addresses, Mr. Miller responding. Luncheon over, all adjourned to the grand stand where the blooded stock, including horses, Jersey cattle and Angora goats, were reviewed. The return trip was made via Titusville and Oil City, a stop being made *en route* to see Drake's well, the original oil well of the United States.

Two exhibition tests of tire expanding with the Wells light were given, the former on Monday evening and the latter Tuesday morning. A pair of 50-in. centres, with tires 2¾ in. thick, were placed on blocking. The sheet iron casing usual to this operation was placed around the wheel. A "Wells light" was placed on either side playing the flame inside of this casing. Six minutes after ignition the burners were applied in this manner and in 19 minutes the tire was driven off with ease. While the tire was sufficiently heated to be removed several spectators placed their hands upon the wheel centre which was still cool enough to admit of so doing. At the second test the opposite tire was taken off and put on again in 34 minutes. In both tests the work was done by one man and an assistant. The success of the trial was applauded loudly by the spectators who were chiefly master mechanics. The same company also exhibited universal joints by which the burners can be placed in any position for boiler work and various other purposes.

Five-Spindle Vertical Boring Machine.

The boring machine illustrated is a recent design, made for use in car and railroad shops where there are a large number of pieces having a duplicate set of holes to be bored of different sizes. With this machine this can be done without stopping to change the auger bits. The machine as shown is arranged with five spindles, all driven by one belt, being without bevel gearing, whereby the noise usual with such machines is avoided.



Five-Spindle Vertical Boring Machine.

The spindles are of cast steel, 1⅛ in. diameter, and can be adjusted across the work independently or all at once, or any two or more can be moved at the same time, through the single hand wheel shown in front of the machine. The spindles have a range of 16 in. each way, vertically and horizontally.

The table is mounted on the main column and is moved with rack and pinion a distance of 24 in., and can be swiveled for angular boring. It is provided with suitable clamps for holding the work. The machine can be fitted with a table 8 ft. long, with rollers for heavy work, the centre roller being arranged with means for moving the work for accuracy in setting. It is also provided with suitable clamps.

The machine is manufactured by the Berry & Orton Company, Arch and Twenty-third streets, Philadelphia, Pa., where further information may be obtained.

Railroad Accidents: Their Causes and Prevention.*

BY H. S. HAINES, VICE-PRESIDENT OF THE PLANT SYSTEM AND PRESIDENT OF THE AMERICAN RAILWAY ASSOCIATION.

I have been requested to prepare for the Railway Commerce Congress a paper upon "Railway Accidents: Their Causes and the Practicable Safeguards Against Them." In seeking the causes of railway train accidents they may be variously classified as between those for which the railway corporations may properly be held responsible as due to defects in track, in equipment, or in regulations, and those for which they should not be held responsible because beyond their control, as when proximately caused by obstructions, by malice, by negligence or by disobedience of orders.

The personal injuries resulting from train accidents may be classified as affecting passengers or employés, or trespassers, or persons rightfully on the railway tracks or grounds; and there is a class of personal injuries by trains which cannot be included in railway train accidents, as occurring at road crossings, or where employés fall from trains or are injured in coupling.

In the discussion of practical safeguards against train accidents something should be determined as to their relative frequency, as attributable to the several causes to which they are due. The official reports of the Interstate Commerce Commission and of the Massachusetts Railroad Commission refer only to those accidents from which personal injuries resulted. The *Railroad Gazette* has for many years published monthly and annually statistics of train accidents in this country grouped as to their character and causes. In an editorial article on Train Accidents in 1892, published in February last, there is a tabulated statement of this kind covering the past 20 years. These statistics are necessarily based upon insufficient data, mainly from newspaper items, but though confessedly incomplete this is all that is available for the purpose. In this statement the accidents are compared in periods of five years, beginning with 1873 and extending to 1892, giving the averages per annum in each period; those in the year 1892 being also classified separately. The classification is under the three general heads of collisions, derailments and accidents neither collisions nor derailments. Then these general heads have been subdivided with reference to the specific causes so far as ascertained. From these statistics I have prepared two tables as follows:

Table A, showing the percentage of each class of acci-

* A paper read at the World's Railway Commerce Congress, Chicago, June 20, 1893.

TABLE A.—RAILROAD ACCIDENTS IN THE UNITED STATES, 1873 TO 1892.
From the Railroad Gazette.

Character of accident.	Annual average number of accidents for five-year periods and for year 1892.					Percentage of total.				
	1873-77.	1878-82.	1883-87.	1888-92.	1892.	1873-77.	1878-82.	1883-87.	1888-92.	1892.
Collisions:										
Rear	155	275	343	464	485	14.7	24.8	25.0	22.1	20.8
Butting	96	121	174	286	251	9.1	10.9	12.6	13.6	10.8
Crossing and miscellaneous	43	21	32	209	326	4.1	1.9	2.4	9.9	14.0
Total collisions	294	417	549	959	1,062	27.9	37.6	40.0	45.6	45.6
Derailments from:										
Defects of road	149	116	192	176	191	14.7	10.5	14.0	8.4	8.2
Defects of equipment	76	79	108	169	206	7.2	7.1	7.8	8.0	8.8
Negligence in operating	97	91	105	125	164	9 2	8.2	7.7	6.0	7.0
Unforeseen obstructions	158	128	156	198	179	15.0	11.6	11.4	9.4	7.7
Unexplained	228	232	187	384	425	21.7	20.9	13 6	18.2	18.3
Total derailments	708	646	748	1,052	1,165	67.3	58.3	54.5	50.0	50.0
Accidents without Collision or Derailment:										
To locomotives	23	29	39	34	34	2.1	2.6	2.8	1.6	1.4
To cars	13	8	18	17	15	1.2	.7	1.3	.8	.7
Cars burned while running	9	8	10	12	12	.9	.7	.8	.6	.6
Other causes	6	1	8	29	38	.6	.1	.6	1.4	1.6
Total accidents without collision or derailment	51	46	75	92	100	4.8	4.1	5.5	4.4	4.3
Total train accidents	1,053	1,109	1.372	2,103	2,327					
Revenue train-mileage, millions			570.7	781 2	870					

TABLE B.—RELATIVE FREQUENCY OF DIFFERENT CLASSES OF RAILROAD ACCIDENTS IN THE UNITED STATES.

Character of Accident.	Number of Accidents in One Million Train Miles.			Train miles run to one accident.		
	1883-87.	1888-92.	1892.	1883-87.	1888-92.	1892.
Collisions:						
Rear	.60	.59	.56	1,666,666	1,694,515	1,785,714
Butting	.30	.37	.29	3.333,333	2,702,762	3,448,272
Crossing or miscellaneous	.06	.27	.37	16,666,666	3,703,703	2 702,702
Total Collisions	.96	1.23	1.22	1,041,625	812,113	819,754
Derailments from						
Defects of road	.34	.23	.22	2,911,173	4,347,821	4,545,454
Defects of equipment	.19	.22	.23	5,263,157	4,545,454	4,347,821
Negligence in operating	.19	.16	.19	5,263,157	6,250,000	5,263,157
Unforeseen obstructions	.27	.25	.21	3,703,703	4,000 000	4,761,904
Unexplained	.32	.49	.49	3,125,000	2,040,816	2,040,816
Total derailments	1.31	1.35	1.34	763,358	740,740	746,268
Accidents without Collision or Derailment:						
To locomotives	.07	.05	.04	14,285,714	20.000,000	25,000,000
To cars	.03	.02	.02	33.333,333	50,000,000	50.000,000
Cars burned while running	.02	.02	.01	50,000,000	50,00 ,000	100,000,000
Other causes	.01	.03	.04	100,000,000	33,333,333	25,000,000
Total accidents without collision or derailment	.13	.12	.11	7,692,317	8,333,333	9,090,909
Total train accidents	2.40	2.70	2.67	416,666	370,370	374,531
Train mileage in millions	570.7	781.2	870			

dents to the total number per annum as averaged in each period.

Table B, showing—First: The average number of each class of accidents in proportion to the number of millions of revenue train miles. Second: The average number of millions of revenue train miles to each class of accidents. The information as to revenue train miles has only been obtained for the periods 1883 to 1887, 1888 to 1892 and for the year 1892.

An examination of Table A presents certain results, as follows: 1. The total number of accidents reported upon has doubled during the total period under consideration. 2. Over one-half of these accidents are classified as derailments. 3. The percentage of derailments per annum decreased from 67 per cent. of the total in the first period to 50 per cent. in the last. 4. The percentage of collisions per annum increased from 28 per cent. of the total in the first period to 45 per cent. in the last. 5. The percentage of accidents that were neither collisions nor derailments has been very small.

In an examination of Table B consideration will therefore only be given to collisions and derailments. This table has been prepared to show the relative probability of the occurrence of any particular kind of accident in proportion to the revenue train mileage. This can only be shown for two periods from 1883 to 1887, and from 1888 to 1892, also separately for 1892. The conclusions to be drawn from this table are as follows:

First: The liability to train accidents has somewhat increased with increasing train mileage; as, for instance, the average distance run for each accident was, for the period 1883-1887, 416,666 miles; for the period 1888-1892, 370,370 miles. This may be due to an increasing tendency to the publication of such matters and consequently to a greater number proportionately to mileage being included in the published statements, but so far as these are reliable they bear out the assertion that train accidents have increased. This does not warrant the inference that the number of personal injuries has increased relatively to revenue train mileage, a matter which will be treated separately.

Second: The increased liability to accidents has been to collisions rather than to derailments, for instance:

Period.	One collision to	One collision to
1883-1887	1,041,625 miles.	812,113 miles.
1888-1892	763,358 "	700,740 "

Third: With reference to collisions alone they are classified as to frequenoy as follows:

Character.	1883-87.	1888-92.
Rear	one to 1,666 666 miles	1,694,515 miles.
Butting	" " 3,333,333 "	2.702,702 "
Crossing or miscellaneous	" " 16,666,666 "	3,703,703 "
Total	" " 1,041,625 "	812,113 "

The proportion of rear collisions to train mileage has remained about the same from one period to the other. There has been a slight increase in butting collisions, but the great increase which has principally affected the total result has been in what are termed "crossing or miscellaneous."

Fourth: With reference to derailments alone they are classified as to frequency as follows:

Cause.	1883-87.	1888-92.
Defects of road	one to 2.941,173 miles.	4,347,821 miles.
Defects of equipment	" " 5,263,157 "	4,545,454 "
Negligence in operating	" " 5,263.157 "	6,250,000 "
Unforeseen obstructions	" " 3,703,703 "	4,000,000 "
Unexplained	" " 3,125,000 "	2,040,816 "
Total	" " 763,358 "	740,740 "

The discussion of the causes of derailment is made less valuable because in so large a proportion of the accidents reported the cause is not given. Referring alone to those for which the cause is given, the relative frequency in proportion to train mileage has increased in those due to defects of equipment and has decreased in those due to defects of road, to negligence in operating and to unforeseen obstructions.

With this general statement of facts and conclusions we must endeavor to discuss the practicability of remedies, beginning with collisions, classified as rear, butting and crossing or miscellaneous. In doing this it is necessary to get down to particulars, for which I will confine myself to the statement of 1892 as given in the *Railroad Gazette* for each month separately.

In the year 1892 the number of collisions reported is as follows:

	Number.	Per cent. of total.
Rear	502	47
Butting	323	30
Crossing and miscellaneous	238	23
Total	1,063	100

Of these collisions some particulars are given as follows:

	Total.	No. particularized.	P. c. total.
Rear	502	230	45
Butting	323	220	68
Crossing and miscellaneous	238	64	27
Total	1,063	514	48

Taking the rear collisions by themselves as particularized, the rear train and the forward train in each can be classified as follows:

	Rear train.	Forward train.
Passenger train	68	39
Freight train	109	112
Freight train parted	35	27
Cars not in a train	2	31
Engines not in train	7	9
Miscellaneous	9	12

In about one-half of these instances it was a freight train that either ran into the forward train or was run into. This is not surprising since there are so many more freight trains than passenger trains. Indeed the large proportion of passenger trains involved in rear collisions as compared with freight trains is more a matter of surprise, though this is to some extent accounted for by the greater probability that a passenger train collision would become a matter of notoriety and get into the newspapers. But in these reported cases the passenger train has been the rear train nearly twice as often as the forward train, which can be accounted for by its greater speed, as tending to make it both more difficult to prevent a rear collision when the passenger train was following, and more easy for the forward train to escape from impending collision when the passenger train was ahead.

In cases where a freight train parted a collision between the two parts appears in this statement as both the rear and the forward trains. In some cases the rear portion of a parted train appears as the forward train where it has been run into by a following train, and in a few instances as the rear train where it rolled back down a grade and into the rear of another train.

The number of collisions with loose cars not part of a train is greater than was to be expected. This is largely due to misplaced switches leading an approaching train into a siding occupied by cars, though in some instances the cars were started out of the sidings and ran down grade into a train on the main line.

These rear collisions may be differently classified in accordance with the place at which they occurred, as, for instance:

Between stations	86
At stations	77
Train parted	27
Misplaced switch	25
Not stated	15
Total	230

With this information as to the circumstances under which these rear collisions took place, reference may be made to the proper remedies, or rather preventives.

Defects in drawgear are accountable for the 27 cases in which trains parted, and negligence of employés for the 25 cases in which a collision was due to a misplaced switch. This leaves 163 collisions nearly equally divided as to the place of occurrence, whether at stations or between stations.

As a general proposition two trains proceeding in the same direction should be separated by an interval of space sufficient for the following train to be stopped at any time within that interval. To accomplish this the engineer of the following train must be informed whenever the limit of that interval is being encroached upon. The extent of this interval of safety must vary with the speed of the rear train, the gradient of the track and the efficiency of the appliances provided for bringing the train to a state of rest—for example, as between a light train, equipped with air brakes proceeding slowly up a one per cent. grade and a heavy train equipped with hand brakes proceeding rapidly down a similar grade. Conditions of weather tending to obscure the range of vision or to lessen the adhesion of wheels to the track or of brakes to the wheels may also serve to extend the interval of safety. When the prevailing conditions extend the limit of this interval beyond the range of vision of the engineer of the following train, it must be preserved in other ways. The Standard Code of Train Rules adopted by the American Railway Association recognizes but two—the block system and the flagman of the preceding train.

In degree of efficiency these two ways are about as far apart as the poles of the earth, one being the latest expression of human ingenuity as applied to railway practice, the other, a makeshift, the inefficiency of which is in proportion to the indolence or stupidity of the flagman. The absolute block system, rigidly applied, will absolutely preserve a stated interval between following trains, but the great cost of its construction and maintenance precludes its use on by far the largest part of the railroad mileage in this country. Where this consideration prevents, reliance is placed upon the watchfulness of the flagman, who is expected, when in his judgment it becomes his duty to secure this interval of safety, to leap from the rear of the moving train and armed with red lantern and torpedoes, to plunge boldly into the darkness of night, perhaps facing rain, snow or sleet, hastening toward the headlight of the following train which glares at him as he feels for his footing on the crossties upon some lofty bridge or long trestle. At length he reaches the prescribed distance of 26 telegraph poles or about one mile, plants his torpedoes and listens with eager ear for the signal of recall. If, through haste to depart or inadvertence, the signal is not given and his train moves off without him, that flagman may pass the night in solitude, perhaps wet, cold and hungry, or until some train stops at his signal and picks him up. Such are the duties required of a flagman, and it takes pluck and endurance to fulfill them

It also takes intelligent judgment to determine promptly under the four rules for flagmen, making 68 lines of the Standard Code, just when a flagman must go back, how far he must go, and what he must do when he gets there. yet this important service is generally entrusted to a novice, to an apprentice in training for promotion to a conductor's place or to some sturdy brakeman, accustomed, it is true, to the hardships of train service, but also to successfully evading them. Either through ignorance or doubt, or fear of being left the flagman may linger around the rear of a train until it is too late for him to stop a following train, or he may disappear in the darkness or just around a curve near enough to be handy when recalled, taking the chances as to whether a train is following or not.

It is safe to say that a majority of the rear collisions between stations are due to a failure of the flagman to comply with the rules prescribed by the standard code for his guidance. Here is the principal cause of rear collisions, and here a remedy should be applied by relying less upon the intelligent and willing discharge of the duties thus placed upon the flagman. The most intelligent and most experienced man in the train crew should be the engineer; the best acquainted with the curves, grades, bridges, cuts, embankments and other physical characteristics of the read; the best informed as to the trains passed and to be passed, and when a stop is made or the train slows down at an unusual place, he knows the cause and the probable detention, not only after it occurs, but also before, and can often select the safest place for a stop. It is he then, and not the flagman or conductor, who should determine when the rear of his train is to be protected, and the flagman should act promptly when the signal is given to him, but not before, except in emergencies that can readily be suggested. If the burden be plainly put upon the engineer to determine and upon the flagman to act, the action of the latter would be controlled by the most intelligent and best informed man of the train crew.

More extended recognition should be given to the use of the time fusee. Its use at night should be obligatory not only by the flagman but also by the engineer. Whenever he is about to stop or slow down his train at an unusual place, he should drop a lighted ten-minute fusee on the right-hand side of the track on which the train is running, one mile before the stop is made, and an interval of ten minutes ahead of the following train is at once secured by a sentinel that will not desert its post, by a signal whose unmistakable light will illumine its surroundings, let the wind blow and the rain fall as they may. Such a use of the fusee will not do away with the protection afforded by the flagman, but rather increase it, for as he crosses a bridge on his way to the rear, he will feel personally safe so long as he sees that purple light blazing between him and the approaching train. Even in the daytime the smoke from a lighted fusee would attract the attention of a following train.

The adoption of these suggestions will measurably reduce the number of rear collisions, but the true preventive is the establishment of an absolute space interval; for any method of time intervals between following trains can afford efficent protection only so long as the trains maintain an uniform schedule speed, can be readily stopped within the recognized interval and are not liable to unexpected delays between signal stations: A heavy freight traffic cannot be satisfactorily

conducted under such a system, yet this was the best method available until it became possible to establish an interval of space by means of the electric telegraph. The fundamental principle of the so-called "block" system is that the engineer of a train approaching a station at the end of a block shall be informed as to whether there is or is not a train between that station and the one next in advance. The interval of safety is thus provided, but the exigencies of traffic have induced what is known as the "permissive" as compared with the "absolute" block system—that is, the permission for a following train to enter a block with the knowledge that it is not clear. This system requires that the rear of the first train in a block must be protected by a flagman with all the vicious consequences already referred to, and where the permissive block system is allowed there should be no dependence placed upon flagmen. When a following train enters a block which is not clear the responsibility should rest upon the engineer of the following train alone to prevent a collision. He knows that there is a train in the block. Let him then proceed with such caution as to have his train under proper control.

But even the absolute block system is defective as a protection against rear collisions until the element of human fallibility has been eliminated. The effort to eliminate human agency begins with the manipulation of the signal at the entrance of the block. If this signal is under the control of the operator at the outlet of the same block, there is one mind the less to make a mistake and this is sought to be accomplished by the "manual controlled" system. But we have also to guard against the mistake of the operator at the outlet of the block. This man has to determine that the block is or is not clear and then to control accordingly the display of the signal at the entrance. He must not only know that an engine has passed out of the block but that every car of its train has also passed out. Even if he be correctly informed as to the condition of the block there must also be a certainty that the signal at the entrance has been properly displayed. Yet another improvement would be attained by eliminating the intervention of this operator also. This has been experimentally accomplished by several devices actuated by the train, simultaneously operating a display of the signals required to block the interval which it is entering and to clear that which it is leaving. Indeed this effect can now be extended to the next block behind the train so that the engineer of a following train may thereby be informed not only as to the condition of the block ahead of him but also as to the condition of the block ahead of that. It is also practicable to provide appliances which will prevent the signal from indicating that the block is clear so long as there is a car of the train left in the block, an intervening switch misplaced or a rail in the track loosened from its fastenings. Here we seem to have reached the uttermost limits of the resources at present available for the avoidance of rear collisions, though it is possible to go a step farther and prevent their occurrence through the misconduct or neglect of the engineer of a following train by the introduction of appliances connected with the block signals which shall strike the engine gong or blow the whistle or apply the brakes or even close the throttle valve on the following train, but these appliances have not yet reached such a stage of efficieney as to call for further notice.

To recapitulate what has been stated the general adoption of the absolute block system would have prevented nearly every rear collision that took place between stations in 1892. But on perhaps 80 per cent. of the mileage of this country, the principal dependence for protection against such collisions is the flagman. Except on roads with very heavy traffic the establishment of the absolute block system is impracticable because of the increased cost of operation consequent upon its introduction. On such roads the flagman must still be relied upon and his usefulness will be greatly enhanced if he be put directly under the engineer's control by whistle signal, and if the engineer be required to rely upon the fusee to preserve the interval of safety for a following train.

The statistics show that rear collisions take place about as frequently at stations as between stations. Such collisions generally occur from the crew of the train standing at the station believing that the engineer of the following train will approach cautiously expecting the track at the station to be occupied, while, in fact, the engineer of the following train approaches the station fully confident that if the track were not clear the flagman would be out a proper distance. Here again the reliance is placed on the flagman with the same unfortunate consequences. The investigation of rear collisions at stations or where the forward train was standing still will show that in most of them the flagman was in doubt as to whether he should go back or not. Perhaps the engineer had only stopped for a few minutes to inspect something about the engine or at the water station where every man on the road ought to know that trains always stopped; or if at a regular station then the train did not stop just at the usual place. Theoretically the flagman always goes back the prescribed distance whenever the train stops. In practice he only goes back to the proper distance when he knows that a train is following, or that he will have plenty of time to get back to his train, or that some official of the road has his private car attached. The remedies are the same as for rear collisions, either the absolute block system or the engineer made responsible for signaling the flagman back. The variety of conditions under which it must be determined whether a flagman should or should not be sent to the rear can be seen by reference to the accompanying circular.*

Another fruitful cause of rear collisions is misplaced switches. There are several remedies for accidents of this kind. In yards the responsibility for a rear collision should rest with the engineer of a following train. He should understand that he will receive no warning by flagmen, only by switch signals, and should always enter and pass through a yard with his train under such control that it could be stopped at least in its length. This should be insisted upon unless switching is forbidden on the running tracks through the yards. Switches not in yards should be provided with counterweighted switch levers that can only be locked on the main line. When in use, a man would then have to be at the switch, and when not in use the counter-weight would bring the switch clear of the main line. Whenever a counterweight switch lever is not used a distant signal should be connected with the switch. To guard against cars being moved out of a siding so far as to foul the main line a derailing device should be placed at the clearance post.

Butting collisions are about as frequent as rear collisions, yet they are much easier of prevention. No two trains proceeding in opposite directions on the same track should ever meet anywhere except at a siding. If the Standard Code is strictly followed this cannot happen, for it gives the absolute right of track to all trains in one direction. This can only be varied by special telegraphic orders, and if the meeting point is correctly given the trains must meet at that point. Where the Standard Code of Train Rules is observed a butting collision cannot occur between stations except through the carelessness of the train dispatcher or of the train crew. Butting collisions do frequently occur at stations and from the same causes that rear collisions occur at the same places; because the train crew at the station expects approaching trains to be under control and because the engineers of approaching trains do not have their trains under control. The remedies are the same for the one class of collisions at stations as for the other.

A crossing collision should never occur. Either a crossing should be so protected by signals and derailing switches as to prevent the possibility of collision, or every train should come to an absolute stop with the engine standing at a stop post 50 ft. from the crossing. In that distance a dangerous speed cannot be attained at the crossing, and when a collision does occur the engineer whose engine struck the other train should be held solely responsible.

The derailments reported in 1892 were classified as follows:

		Per cent. of total particularized.
Defective track	104	33
" equipment	63	20
Unforeseen obstructions	95	32
Negligence in operating	49	15
Total particularized, 26 per cent.	311	100
Unexplained, 74 per cent.	887	
Total reported	1,198	

Particulars of derailments have only been obtained of about one-fourth of the cases reported. Of those particularized about one-third each have been caused by defective track and unforeseen obstructions while the remaining third was about equally divided between defective equipment and negligence in operating.

The reported cases due to defective track are classified as follows:—

Broken rail	35
Defective switches or frogs	21
Rails spreading	14
Defective bridges or trestles	12
Bad track	11
Miscellaneous	11
	104

Over one-third of the derailments due to defective track occurred from broken rails. In the majority of cases a broken rail means a badly worn rail or one of a section too light for the traffic. The responsibility for a derailment from rails spreading or from bad track should be easily placed upon the proper shoulders, and derailments from defective switches, frogs, bridges and trestles are plainly due to lack of inspection, as also in the most of the cases classed as miscellaneous.

The derailments due to defective equipment were 137 in number, of which particulars are given of 63, or 53 per cent., divided as follows:—

	On locomotives.	On cars.	Total.
Defective wheels	4	17	21
Defective axles	1	10	11
Defective trucks		10	10
Defective drawgear		9	9
Defective brakegear	1	8	9
Miscellaneous	1	2	3
Total	7	56	63

The number of derailments attributed to defective locomotives as compared with defective cars is greatly out of proportion to the number of each in service, but the total of the cases particularized is too small to draw any conclusions except that the remedy lies in closer inspection.

The derailments due to negligence in operating were 163, of which particulars are given in 49 cases, or 30 per cent., as follows:

Carelessness in handling switches	29
Carelessness in handling locomotives	14
Carelessness in track repairs	4
Miscellaneous	2
Total	49

The switch accidents, as already mentioned in discussing collisions, can be largely reduced by the use of a counterweighted switch lever which will prevent switches being carelessly left open on the main line. Two derailments of passenger trains were caused by derailing devices at crossings, and in each case a collision was probably averted. But one derailment is reported from an open drawbridge.

The derailments due to unforeseen obstructions were 165 in number, in which the particulars are given in 95 cases, or 57 per cent., as follows:

Cattle	36
Washouts	14
Malicious obstructions	13
Land slides	8
Miscellaneous	24
	95

The principal single cause, cattle on track, could be prevented by fencing. In the majority of the other cases the remedy is closer inspection. The other train accidents, which were neither collisions nor derailments, were 95 in number, of which particulars were given in 42 cases, or 44 per cent., as follows:

Locomotive explosions	18
Other accidents to locomotives	9
Miscellaneous	15
	42

Some of the train accidents, as above classified, were more or less involved, either as cause or effect, with bridges and fires, and it is, therefore, somewhat interesting to treat of them as so related.

In 21 cases of derailment caused by condition of bridges the particulars are as follows:

Bridge damaged by flood	8
Bridge damaged by fire	5
Bridge otherwise defective	6
Insufficient bridge signals	2
Due to insufficient inspection	21
Injury to bridges by train accidents:	
By derailments	7
By collisions	5
Total	12

In seven derailments and one collision the trains were thrown off a bridge, so that it may be said that in these eight cases and in the 12 cases of injury to bridges by derailment and by collision efficient guard rails would have prevented the resulting damage.

As with bridge accidents so it is with accidents by fire, they may be either a cause or an effect.

In 61 cases of fires on trains of which particulars are given the causes were as follows:

	Pass.	Freight.	Total.
Rear collision—engine set train afire	5	21	26
" " caboose stove	..	2	2
" " lamp in horse car	..	1	1
" " lamp in baggage car	1	..	1
Butting collision—engine set train afire	2	3	5
" " stove in express car	1	..	1
Crossing collision—stove in passenger car	1	..	1
Derailment—stove in passenger car	11	..	11
" fire from engine	1	3	4
" contents of freight car	..	3	3
Illuminating gas	1	..	1
Case of gasoline dropped from preceding train	1	..	1
Total	24	33	57
Set on fire by locomotives	8	27	35
Set on fire by stoves	13	2	15
Set on fire by lamps	1	1	2
Miscellaneous	2	3	5
Total	24	33	57

The remedy against fires caused by locomotives is plainly to reduce the number of collisions, and especially of rear collisions, and that against fire caused by stoves is to replace them with safer heating apparatus.

In general, the diminution in railway accidents must be brought about by increased efficiency in appliances, in regulations, in discipline and in inspection.

Under the head of appliances experience shows that rear collisions between stations can be greatly diminished by a more extended use of the block system; that many collisions are caused by switches left wrong which could not occur with counterweighted switch levers; that cars could not be moved out of sidings if prevented by derailing devices; that derailments at switches could be prevented by the use of safety switches; that guard rails on bridges and trestles would often prevent derailments and the consequent injuries to trains and structures, and that steam heating apparatus should replace stoves in passenger cars.

As to efficient regulations, the Standard Code of Train Rules of the American Railway Association is the result of the experience of those best qualified to frame such a

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* Circular No. 2.

SAVANNAH, FLORIDA & WESTERN RAILWAY,
SAVANNAH, Ga., Oct. 25, 1890.

TO FLAGMEN.

Your attention is hereby called to the rules which prescribe your duty under the different circumstances in which you may be placed.

ON PASSENGER TRAINS.

No. 1. At regular stations noted on schedule as a stopping place for that train, and standing at the usual place for it to stop. See Train Rule 229. If your train stands over five minutes, you must go back with danger signals and protect your ain, as provided in Rule 99.

No. 2. At regular stations noted on schedule as a stopping place for that train, but not standing at the usual place for it to stop. This is an unusual stop, and you must comply with Train Rule 96.

No. 3. Stopping at stations not noted on schedule as a stopping place for that train. This is an unusual stop. See Train Rule 96.

No. 4. Stopping for wood or water between stations. This is an unusual stop, to be governed by Rule 96.

No. 5. Stopping between stations for engineer to examine something about his engine. This is an unusual stop, and you must be governed by Train Rule 96.

No. 6. Stopping between stations to pack hot boxes. This is an unusual stop. You will be governed by Train Rule 96.

No. 7. Any other stop between stations. See General Manager's Order No. 300, also No. 299, which reads "all other stops must be considered unusual stops." You will be governed by Train Rule 96.

FOR FREIGHT TRAINS.

No. 8. At regular stations not noted on schedule as a stopping place for that train, and standing at the usual place for it to stop. You will assist the conductor in shifting switches, discharging freight, etc., but if the train is delayed 20 minutes beyond its scheduled leaving time, you will be governed by Train Rule 97.

No. 9. At regular stations noted on schedule as a stopping place for that train, but train over-lapping switch. You must consider this an unusual stop, and you will comply with Train Rule 97.

No. 10. At regular stations noted on schedule as a stopping place for that train, but not standing at the usual place for it to stop. This is an unusul stop, and you must comply with Train Rule 97.

No. 11. Stopping at stations not noted on schedule as a stopping place for that train. This is an unusual stop, and you must comply with Train Rule 97.

No. 12. Stopping for wood or water between stations. This is an unusual stop, and you will be governed by Train Rule 97.

No. 13. Stopping between stations for engineer to examine something about his engine. See General Manager's Order No. 300, also General Manager's Order No. 299. The above stop is an unusual stop, and you must be governed by Train Rule 97.

No. 14. Stopping between stations to pack hot boxes. This is an unusual stop, and you will be governed by Train Rule 97.

No. 15. Any other stop between stations, cause unknown to flagman. See General Manager's Orders 299 and 300. Stops of this character must be considered unusual stops, and you must be governed by Train Rule 97.

These instructions do not relieve the conductors or engineers from the responsibility which the rules prescribe. Your attention is called to Train Rule 47, and when the signal is given for flagman to go back, the warning must be immediately obeyed.

When engineers throw off lighted fusees, as per General Manager's Order No. 300, you will understand that it is his intention to stop, and you must be prepared to go out immediately with proper danger signals.

At night you must remember to comply with Train Rule 230 as to use of fusees.

Never forget that you are placed at the rear of the train to protect life and property, and that it is in the darkness of night, in fogs and in storms that your prompt attention to duty is most valuable.

It is better for your own peace of mind that you should get wet or be left on the road, cold and hungry, than for you to see life lost, perhaps your own friends mangled and crippled, or engines and cars broken up in a collision through your own carelessness or laziness, or because you did not go back when you knew that you ought to.

TO ENGINEERS AND CONDUCTORS.

Your attention is called to this circular. See that flagmen understand it and act upon it. Pay strict attention to what is required of you as to giving whistle signals or verbal instructions to flagmen; also as to dropping fusees in ample time when you know in advance that you intend to stop at an unusual place. You will thereby assist your officers in protecting your own lives, as well as the lives and property which it is your duty to protect. You will also add to the reputation of the railroad company which employs you, and in which, I believe, you take as much pride as I do.

H. S. HAINES,
General Manager.

code. Its general adoption has done much to bring about a uniformity of practice throughout the country, and with it to reduce the possibility of accidents due to trainmen changing from one road to another. As already suggested, it would be an improvement for the engineer of a train to be required to make use of the fusee as a rear protection, and also to put the flagman more immediately under his direction.

The Association Code of Rules for the movement of trains by telegraphic orders is an admirable piece of work and has been even more generally adopted than the Code of Train Rules. Where it is rigidly enforced a butting collision could only arise from the carelessness or recklessness of an employé. There is need for similar Standard Codes regulating the conduct of employés in other matters incidental to the movement and handling of trains.

Perhaps one of the greatest fields for improving the train service in this country is that of discipline. The lack of unquestioning obedience to authority and of prompt compliance with established rules is at the bottom of more railway accidents than all other causes put together. This is rarely shown in the newspaper accounts; indeed it is only ascertained in most cases by a thorough investigation of all the circumstances. The facts as to the chances taken daily by reckless or indolent or careless employés in flagrant disregard of carefully devised regulations and of even the common dictates of prudence would, if generally known, do much to bring about an improvement in this respect. Public opinion would then hold employés responsible in many cases of accident where now there is a senseless or unjust abuse of corporations and officials. It is now so difficult to get a jury to look upon the infraction of a train rule by an employé as a crime that railroad companies content themselves in such cases with discharging men who are then free to find employment elsewhere and to repeat the offence, and the attempt to keep a record of such offenders is denounced as odious blacklisting. Railroad managers have to contend against a growing resistance to restraint and reproof, and a disposition to oppose the interests of the company in matters which do not affect the personal interest of employés either one way or another, thus rendering it difficult to enforce discipline even where the safety of life and property are involved. Their efforts need to be reinforced by public opinion, by the press and by the courts, for strict discipline and prompt obedience to orders under conditions of exposure to weather, to danger and even to death are as necessary and as meritorious in railroad service as in military service.

In this connection railroad managements are themselves open to censure for inefficient supervision of train service. They have the lesson to learn which centuries of experience have taught to the creators and leaders of military organizations; that it is one thing to give an order and another thing to see that it is enforced. Close inspection insures efficiency of appliances, of regulations and of discipline, and this is greatly lacking even on the best railroad systems in this country. Money expended in salaries for men to do nothing else but see that rules are observed is looked upon as wasted. What is wanted is not spies or detectives, but a staff of inspectors reporting directly to the general manager outside of any department officials. This is what is done in armies, and the positions are held in honor and filled by the best men on the general's staff. With such a system of inspection the management does not have to wait for a bridge to fall down to learn that it was rotten, or for a score of lives to be lost in an accident to know that train rules were habitually disregarded.

As stated in the beginning of this paper, the personal injuries arising from railway accidents have attracted the attention of State Railway Commissions rather than the causes of such accidents, and some reference may therefore be made to this aspect of the subject. The classes of persons suffering injuries from railway accidents are passengers, employés and trespassers as well as a fourth class of persons that cannot properly be included under either of these heads. I have, therefore, prepared some figures as to the number of persons injured by train accidents in 1892, which have been already analyzed as to their causes. Classified as stated the results are as follows: The total number of persons injured in these accidents was:

Killed	664	
Injured	2,252	
		2,916

Divided as follows:

Passengers	1,150	
Employés	1,648	
Trespassers	85	
Miscellaneous	33	
		2,916

These casualties resulted from:

Collisions	1,458
Derailments	1,379
Other accidents	79

The principal causes of personal injuries were:

	Killed.	Injured.	Total.
In rear collisions	116	462	578
In butting collisions	200	525	725
Derailment from broken rails	15	196	211
Derailment from cattle on track.	30	98	128

There were 61 accidents in which the trains took fire, and from these fires 10 passengers and three employés were killed, and 13 passengers injured.

The resulting injuries from train accidents vary, of course, greatly with the number of persons exposed in each, while serious loss of life occasionally results primarily from irregularities which are themselves of but little consequence and of rare occurrence. Colonel Haines also presented a table giving separately each accident reported in 1892, which resulted in ten or more persons being injured. A derailment on a high bank, caused by a broken rail, resulted in two deaths and 34 injured. Another to a work-train, with 300 men on board, also happened on a high bank, plunging the train into a river, drowning three and injuring 30. Another derailment caused by a trestle giving way, after having been weakened by a flood, resulted in drowning seven and injuring 30. A passenger train ran past a block signal and plunged into the rear of another passenger train, killing 12 passengers and injuring 23. A butting collision growing out of the mistaken reading of a new time card led to the death of five and the injury of 43 others. A freight train ran past a block signal, into the rear of a passenger train, killing nine and wounding 32. These examples are given to show that as any class of collision or derailment may result in great loss of life, in seeking a remedy our attention should not be so much attracted to those, which for this reason have a tragic interest, as to those causes which investigation shows to have been most abundant in accidents. So far as information may be gained from the train accidents of 1892, but few of them can be attributed to causes beyond the control of man. In most of them the remedy is to be sought in more efficient appliances, regulation, discipline and inspection.

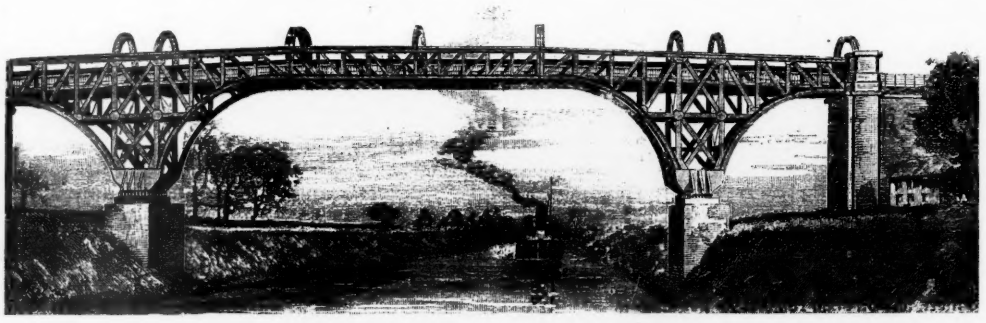
A Bridge Over the Manchester Ship Canal.

The engraving, taken from *The Engineer*, shows a high-level cantilever bridge erected over the Manchester ship canal. Mr. E. Leader Williams, Chief Engineer. It is shown here as an interesting example of English bridge work. The width between girders is 26 ft., the span from centre to centre of piers 207 ft., and the length of the connecting girders 92 ft. The first plan was to have a swing bridge at this point, but considering the small quantity of highway traffic, the isolated position of the bridge and the cost of maintaining power to operate it, it was decided to make a high level, fixed bridge instead. When the shore ends had been completed and anchored the connecting girders, which had been built on pontoons below, were raised and dropped into position by derricks, the cross girders being added afterward.

Freight and Special Cars at the World's Fair.

The display of freight cars at the World's Fair is very incomplete, so far as box, gondola and flat cars are concerned, of which there are probably not over half a dozen exhibits. Of refrigerator, stock and special cars of various kinds, the exhibit is extensive and interesting. Nearly all of the more prominent of the fast freight lines have one or more of their standard cars on exhibition. These are, as a general thing, no better than, or in any way different from, those in daily use, except that they are all in first-class condition and freshly painted. Their construction is not unusual, except in one or two cases, to which especial reference will be made.

Arms Palace Horse Car Co.—This company has on exhibition two of its horse cars, built by Barney & Smith, of Dayton, O., one of which is especially fine. This car is equipped with passenger trucks and the Janney passenger coupler, and is intended to be hauled in passenger and express trains. It contains stalls for 16 horses, the stalls being arranged longitudinally with the car, four in each end and eight at the centre of the car. The car is virtually divided into two equal parts, each part or section carrying eight horses, all with heads toward the centre of their section. There is a means provided for passing from one section to another at will. Each section has sliding doors on each side. This car is especially commodious and well fitted for the transportation of horses with comfort both to the animals and their attendants. The length over end sills is 45 ft. 3 in.



Warburton Road Bridge—Manchester Ship Canal.

The other car exhibited by this company is of its ordinary type, and is provided with stalls for 18 horses. These stalls are placed transversely and the partitions between the stalls are hung on hinges so as to facilitate the loading and unloading of the animals. The horses are fed and watered from a manger extending along the side of the car in front of the stalls. The stalls are padded in such a way as to prevent a horse from injuring itself by kicking or stamping. There are but two doors, and these at the centre of the car. The space from each side of the door to the end of the car is filled with stalls, thus leaving but very little waste room in the car. The car is intended to run in freight trains and is equipped with an ordinary freight truck and the Janney freight coupler. Both cars are provided with the National hollow brakebeam.

Eastman Freight Car Heater Company.—This company also exhibits two cars; one its automatic refrigerator car, and the other its heater car. Both these cars show evidence of careful designing and are well worth the attention of those having to make shipments requiring a constant temperature of air. The refrigerator car, like most other cars of its kind, is provided with iceboxes or tanks at each end which serve to keep the air cool. Unlike most other cars, however, the circulation of air is regulated by an automatic thermostat in the top of the car which controls the position of a valve past which the air flows after leaving the storage-room of the car, also in having the air pass underneath the floor of the car and between the sills to the centre of the car before entering the storage-room. It is claimed that by this system of refrigeration a very equable temperature can be maintained for several days with a comparatively small quantity of ice. This car is mounted on the Fox pressed steel freight truck.

The heater car which this company exhibits is probably the only successful car of its kind in operation. The air is heated by a small oil stove placed beneath the centre of the car, in a chamber, from which run hot air pipes to various parts of the car. The arrangements are such that the air is kept always in circulation and the temperature of all parts of the car very nearly constant. Oil enough is carried to supply the lamp or stove for several days.

The Merchants' Dispatch Transportation Company.—This company exhibits one of its standard refrigerator cars, manufactured under the Wickes patents, and of which there can be no need of description, the car being familiar to every railroad man and shipper in the country. The car is equipped with the standard coupler, Fox pressed steel truck and Central brakebeam, and has a capacity of 40,000 lbs. The weight of the car is 39,000 lbs., and the capacity of ice tanks 4,500 lbs.

Mather's Stock Car Company.—This company has on exhibition one of its standard stock cars, built by the Youngstown Manufacturing Company, of Youngstown, O. The car in many particulars resembles others of its type, being provided with the usual water trough and a rack, and it is of about the usual capacity. The car is equipped with the Schoen brakebeam and centre plates, the Boyden company's airbrakes, Griffin car wheels, Butler drawbar attachments and the Mather drawbar.

United States Car Company.—One of the later designs in refrigerator cars is exhibited by this company in a dressed beef car of 60,000 lbs. capacity, built under Hanrahan's patents, and illustrated in the *Railroad Gazette* of Oct. 30, 1891. It weighs 42,500 lbs., and for its capacity is one of the lightest refrigerator cars in use.

American Refrigerator Transit Company.—This company exhibits a 50,000-lb. capacity refrigerator car built at its works, and differing in few respects from other cars of the type. The ice tanks or boxes are located at the ends of the car, and the air, after passing over the ice, is discharged through openings just above the floor and passes upward and toward the centre of the car and returns to the icebox through passages in the roof of the car. The car weighs 38,500 lbs., is provided with a Safford drawbar, the Butler drawbar attachments and the National hollow brakebeam.

Hicks Stock Car Company.—This company exhibits an exceedingly well built and well designed stock car of 40,000 lbs. capacity, and weighing 31,700 lbs. The car is provided with the usual appliances for feeding and watering stock with facility. A drop partition is placed at the centre of the car and operated by a hand wheel. It is so arranged that it can be rolled up on a shaft, throwing together the two ends of the car whenever desired. The racks are so arranged as to be hooked up out of the way when not in use. The car is mounted on trucks of an especially good design and is equipped with the St. Louis coupler and National hollow brakebeam. The builders of the car are the Terre Haute Manufacturing Company, of Terre Haute, Ind.

Pennsylvania Railroad Company.—This company exhibits one of its well known Union line refrigerator cars mounted on standard freight trucks, and weighing 41,400 lbs. The car has a capacity of 60,000 lbs. and is fitted with the Westinghouse airbrake, the Graham draft rigging and the Janney coupler. Another car exhibited by this company which attracts considerable attention from railroad men is the track indicator car used in testing and recording the condition of the track as to alignment, gauge, surface, joints and elevation of curves. Records of the condition of each mile of track are preserved and show any change taking place from time to time. The company also exhibits the track inspection car used in the annual inspection of track and property. The car is provided with seats so arranged that a full view of tracks and roadbed can be obtained while the car moves at a slow speed in front of the locomotive.

Old Colony Railroad.—The Keith Manufacturing Company, of Sagamore, Mass., has built for this company a very strong and durable ballast car of 60,000 lbs. capacity, weighing 24,200 lbs. The car is very well designed and is mounted on Fox trucks and equipped with the Trojan coupler, the Westinghouse brakebeam and Westinghouse airbrakes.

Street's Western Stable Car Line.—This company exhibits a three-compartment stable car of its well

known design, with space for 18 animals. These cars are provided with false sides hung at the bottom, carrying hayracks, and controlling the operation of the water trough. Water is fed from a small reservoir at the top and centre of the car through small pipes leading to each trough. The sides are moved by a lever which is operated from the top of the car. The length of this car is 36 ft. inside. Its capacity is 40,000 lbs., and weight 29,800 lbs.

Morris & Company's Refrigerator Line.—One of the most gorgeous of the many refrigerator cars exhibited is that built under patents controlled by Nelson Morris & Co., and built by the Wells & French Company, of Chicago. The car is somewhat large, but of the usual construction in most respects, and provided with overhead rack and hooks for hanging beef. The car is equipped with the King yielding side bearings, pressed steel centre plates, American continuous drawbar, the Gould coupler and Westinghouse airbrake. The truck is of the ordinary type with swing bolster.

Live Poultry Transportation Company.—This company exhibits a 34-ft. car built by the Ohio Falls Manufacturing Company, of Jeffersonville, Ind., and intended for the transportation of live poultry. The car has 138 compartments with a capacity of about three dozen chickens each, every compartment being easily reached from an aisle through the centre of the car. The sides of the car are covered with a strong wire netting and the side of the compartment next to the aisle closed by a drop gate. There is a large open space in the centre of the car for the storage of grain. Each compartment is provided with a small watering trough.

Harvey Steel Car Company.—The cars exhibited by this company are similar in construction to those illustrated in the *Railroad Gazette* of June 5 and Sept. 18, 1891, and June 20, 1893, and are:

A 34-ft. box car of 60,000 lbs. capacity and weighing 28,700 lbs. The car is fitted with the Westinghouse airbrakes, Pooley couplers and the National hollow brakebeam.

A 34-ft. gondola car, weighing 34,350 lbs., and capacity of 60,000 lbs.; furnished with steel stakes and equipped with the Hinson coupler, Westinghouse airbrake and National hollow brakebeam. The side bearings are of the roller pattern.

A tank car weighing, without the oil tank, 19,200 lbs., and having a carrying capacity of 8,000 gals. of oil. This car is equipped with the Safford drawbar and Westinghouse brakebeam.

These cars are all mounted on the Harvey standard freight truck.

The Ensign Manufacturing Company.—Among the most interesting of the various stock cars exhibited in the Transportation Building is that built by the Ensign Manufacturing Company after the patents of Mr. F. E. Canda for the Canda Cattle Car Company. The company also shows a gondola car of 60,000 lbs. capacity, built for the Mexican International Railroad, and provided with sliding doors in the bottom of the car operated by means of a lever at the side of the car. The sides of this car are well trussed by means of a longitudinal rod near the top of the car.

A flat car of 60,000 lbs. capacity, 41 ft. long and weighing 23,000 lbs., illustrates a new method of trussing underframes, and one which it is claimed has shown excellent results in service.

Bloomsburg Car Company.—The application of the beamless brake, illustrated in the *Railroad Gazzette* of May 12, 1893, is shown in a 50,000 lbs. capacity gondola car built by this company and equipped with the Butler drawbar attachments Empire couplers and Westinghouse airbrake. The company also exhibits a rotary dump car, the body of wh ch swivels on a large centre plate, and is hinged under the centre so as to permit of dumping the contents of the car in any direction.

The Elliott Car Company.—The Elliott Car Company, of Gadsden, Ala., exhibits a ventilated car for fast freight service, which is built entirely of material found within the state, the car thus serving to call attention to the resources of Alabama as well as to indicate the style and class of work this company is doing. The car is equipped with the Elliott M. C. B. coupler, the National hollow brakebeam and New York airbrake.

The Anglo-American Provision Company.—This company exhibits one of its well known refrigerator cars of 50,000 lbs. capacity, equipped with the Westinghouse airbrake and showing the application of Clarke's steel fender.

The Burton Stock Car Co.—This company has two cars on exhibition, one being its ordinary horse or stock car and the other its perfected horse car. The first car has an inside length of 36 ft., weighs 32,900 lbs. and has a capacity of 30,000 lbs. The car is provided with iron feed racks in which hay is introduced from the top of the car in the usual manner. The operation of the watering trough is also controlled from the top of the car where there is placed a small tank from which water is conducted to the troughs along the side of the car. The car is equipped with the Westinghouse air brake, Safford drawbar, National hollow brakebeam, and mounted upon the Fox freight truck. The perfected horse car exhibited by this company is somewhat longer than the other car, is mounted on passenger trucks and has stall room for 16 horses. The stalls are arranged longitudinally, as in one of the cars previously mentioned, with lattice partitions with a considerable range of transverse adjustment. The stalls are so padded as to prevent injury to animals and means provided for proper drainage of the car floor. The watering troughs are suspended from the roof of the car and when lowered into place serve to prevent the animals from leaving their stalls. Ventilation is effected through openings under the hoods at the ends of the cars, and the clearstory sash. The car is equipped with airbrakes and provided with steam and air signal hose for use in passenger trains.

Hutchins Refrigerator Car Company.—This company exhibits two cars, one a refrigerator car of the usual type, and the other a refrigerator car intended especially for the transportation of fruit, and quite extensively used in the fruit trade between California and Eastern points, in which service it is giving the best of satisfaction. The principal features of these cars are not especially different from one another or from those of other cars in common use. The ice capacity and cooling surface is, however, unusually large. The cars are equipped with the Miner draft rigging, which was illustrated in the *Railroad Gazette* of June 16, 1893, and with the King angular brakebeam, which was also illustrated in the same issue of the *Railroad Gazette*.

Firebox Steel.

At Tuesday's session of the Convention of the Master Mechanics' Association, the President invited Mr. Samson Fox, of the Leeds Forge Company to address the Convention. His excellent address, which took the form of a discussion of the report of the Committee on Tests of Steel and Iron, follows in full.

I consider you have done me a great honor in asking me to say a few words on the all important question of the material of which our boilers have to be built. I would, in the first place, ask you to consider that I do not come here as a teacher in any manner or shape. I do not come to teach any one his business. But as I happened to be in this country for the last two weeks, of course I have met quite a number of gentlemen interested in the question of firebox plate. Firebox plate, for the purposes of fireboxes at sea, I have manufactured for a long number of years. I think if I were to say to you that I have turned out within the last 14 years at least one hundred thousand tons of firebox plate which has been used solely for the purpose of making steam I should be within the mark. You know that a man who has done a large amount of work must have made a large number of blunders, and it is out of the blunders that he finds what may be considered the best way of keeping the straight path.

What we consider in firebox plate making, first of all, is to select very pure materials. That is to say, we will take pig iron which contains in nature the smallest amount of sulphur and phosphorus. We do not mind very much the amount of silicon nor the amount of carbon. We consider that it is necessary to know exactly the composition of the fuel that we use in every part of the work so that the gas from the fuel shall have the same value in purity as the pig iron that we have already started to work with. Having these together, and both clear from these very serious enemies, sulphur and phosphorus, we may then go to work and expect to obtain a fair, reasonable result. It is important also that the linings of the furnace, such as the sand and ganister that you use, and also the bricks of which it is built, shall be as pure as the gas and pig iron. Therefore when the action is thorough there is no doubt that after such a start you will get as a result a pure plate.

For firebox purposes it should have about .11 per cent. of carbon. You may put from .50 to .55 of ferro-manganese into it, but you should get your sulphur and phosphorus down to as low as .04 to .05. If you do that you will have a material which, if properly manipulated from the ingot down to the shorn plate, will do almost anything as regards standing fire and every other manipulation involved in turning it into first class boilers.

I believe in some factories in this country it is thought not necessary to put any work on the ingot. We hold a different opinion. We prefer for the best class of work to hammer the ingot, reducing it from about a 15 in. thick ingot down to about 5. That ingot is hammered on the flat and on the edge and the ends are cut off. It is necessary to exercise care in reheating such a slab, because we all know that we are troubled at times with lamination in the plate, and it generally occurs at the end of the plate. That has been clearly proved over and over again to be caused by the overlapping of one side of the plate over the other. Men who are rushing their work will bring out their slabs not so well heated on one side as on the other; and when such a slab enters your rolls, the soft side will run ahead and draw farther than the hard side, and the hard side is, as it were, rolled partially into the soft slab. This may not show itself even when the plate is shorn, even when it has been annealed, but still it will show itself in working some day. It will show itself when it comes to deal with the expansion and contraction due to its work in the boiler.

Now, the question for the user should be to buy only on certain mechanical tests and chemical composition. If the committee were to look fairly into the different tests set forth either in France or in Germany or in England they would find that there is a steady growth of the practice of standard tests especially for firebox work. Those tests need not be anything further than specified, and inspectors ought to see these plates tested on these grounds. The Board of Trade, the Admiralty of England and many other associations, such as Lloyds and the Bureau Veritas, set down that a peace of material shall be cut from the plate which shall in 10 in. of length elongate from 20 to 25 per cent. The British Admiralty specification is 25 per cent., so is the Russian Admiralty and so is the French Admiralty; but the Board of Trade goes down as low as 20 per cent. The elongation, whether 20 or 25 per cent., is the elongation taking place within 10 in. of length pulled in an ordinary testing machine. In addition to that the Admiralty specifies tensile strength; it must not be more than 25 tons to the square inch, and usually not less than 24. Those are our gross tons, 2,240 lbs. Now, if you are bound within the range of a ton you have got to have your chemical composition uniform all through all the plates you make; and if you get an elongation such as I have mentioned, of 20 to 25 per cent., that will be a material that will do very good work.

We have found by experience that there should be a little difference in the amount of carbon according to the thickness of the plate that you are making. If you are starting with .11 for a quarter inch plate and you are going to make half inch plates which shall bear the same 25 tons and not less than 24, and with the same elongation of 25 or 20 per cent., you must put a little more carbon into the half inch plate than you put into the quarter inch plate, and so on. Otherwise you will not get the same tensile strength, because your material is made more dense in rolling down to a quarter inch plate than to a half inch or three-quarter inch plate.

These features have led to pretty fair success on our side. I have made many thousands of tons of plate where I have undertaken to be not more than ten hundred weight on either side of the given point, and that can only be done by watching the carbon in regard to the thickness of the plate. I am sure that if the users of plate in this country were to lay down a standard of purity and strength and elongation of plate it would be the very first thing to do in order to get that uniformity in firebox plates which is so much required. Of course a great many plates would have to be thrown out, but there is nothing like having a lot of material thrown out to make a man find out what is the right thing for him to do.

We employ a method of determining the amount of carbon which is known as the color test. We take a known weight of a chemically pure iron, or a known weight of steel with a known quantity of carbon. That known weight of pure iron is dissolved in acid and a known weight of water mixed with it, which produces a rather crimson colored liquid. More water added brings it to yellow. We take our supposed pure iron from the furnace and we weigh the same quantity and dissolve it with the same quantity of acid as the other, and then fill up two test-tubes that are graduated with such a quantity of water as will bring both the liquids to the same shade of color, looking at it upon a sheet of white paper. The result is that when you read off the difference in the water on the scale of the two tubes you know the difference in the carbon between one and the other. One is considered to be without carbon entirely, and the other may have a little in it. That process can be carried through in 10 minutes. If you want to know what carbon you have in a piece of finished material, you treat it in the same way. You read off what the differences are and the quantify of water, and get the two acids the same.

There is no doubt that you will always get the best results by taking the testpieces lengthwise, but we do not want that; we want the worst condition of the plate, and we get that by taking the testpiece off crosswise. We always adopt that system and it is a satisfactory one, inasmuch as when you have got your standard of density and elongation on a piece cut crosswise you are much more sure to be right lengthwise.

Mr. HENDERSON: I would like to ask Mr. Fox what that steel is worth per pound.

Mr. FOX: That material is sold for about nine pounds sterling per ton of 2,240 lbs. [2c. per lb.] Of course you cannot produce the same class of material at the same price in this country.

Mr. BLACKWELL: What would be the result of reducing phosphorus and sulphur, say, to .02 and .025 or .030 respectively. Would it give any better material for firebox plate?

Mr. FOX: It would give better results as regards cracking or starring, or anything due to the application of the heat on one side and water on the other. But when you get down to completely pure iron you loose the dignity of the material to an extent that allows other difficulties to creep in, such as grooving and pitting of the plate due to various changes of water. Those constituents in small quantity, where they do not interfere with the ductility of the material, are, in my opinion, a considerable safeguard against what occurs when a very pure iron is placed in contact with water that is being made into steam, such as pitting and grooving. We have been troubled with that with some classes of waters in marine boilers. But they can get over that by introducing zinc into the steam space. The zinc, by degrees, deposits itself over the surface of the plates, and the result is a whitish covering, which seems to protect the plate perfectly from these difficulties of grooving and pitting.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
Published Every Friday.
At 73 Broadway, New York.

EDITORIAL ANNOUNCEMENTS

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

During the discussion at the Master Car Builders' Convention on the matter of chilled wheels the statement was made that the Barr is the only contracting chill. This, we take it, came from a misapprehension of the meaning which is attached to the name "contracting" chill. That name was used for the Whitney chill before the Barr chill was invented, and we think properly. A contracting chill may be defined as one in which the circumference of the chilling surface (that is the circumference in contact with the poured wheel metal) diminishes as the metal cools. This effect is produced by the elongation of webs which carry the chilling blocks, as they absorb heat, from the metal in the chill. These webs being thin expand rapidly in their longitudinal direction and transmit the heat slowly to the outer ring of the chill. Consequently, while that ring remains practically of the same circumference, the inner, or chilling, circle diminishes in circumference as the segments of which it is composed are carried in radially by the elongation of the webs. This effect is obtained in all of the contracting chills—the Whitney, the Canda, the Snow and the Barr. The peculiarity of the Barr chill, which perhaps leads to the claim that it has more contracting effect than the others, is that it has a channel in the outer ring through which steam or water may be made to flow; and in operation this ring is heated by putting steam through it and then, at the time of pouring the metal, it is cooled by allowing water to flow through the channel. We have always been skeptical as to the practical effect of this, as it seems improbable that in the very few seconds during which the chilling effect is produced there can be any valuable change in the circumference of the outer ring; and we are inclined to think that the contracting effect in the Barr chill is produced precisely as it is in all the others. Indeed we have been told that the steam and water are not used in some of the establishments which use the Barr chill, and we question very much if there is any gain in the use of the steam and water that would compensate for the cost and complication of fitting up the piping and connections by which to make their use possible.

Pending the publication, in a later issue, of our semi-annual statement of new railroad built in the United States, we print this week a list of the total mileage for the half-year by states, as made up from the preliminary reports. The total, 896 miles, is nearly 400 miles less than the mileage built in the first half of 1892, and is less than for the first half of any year, for a dozen years at least. We have before pointed out that the new railroad built in the first six months of any year is for many reasons less than in the last half, and is generally between 30 and 40 per cent. of the total railroad building in the year. It will be seen therefore that unless some special impetus is given to railroad construction work in the next few months,—and certainly present financial conditions give no reason to expect any improvement, early enough to affect railroad building this year,—the amount of track laid in 1893 will be less than for any year for the last ten years. As has been the case for four or five years, the majority of the new mileage consists of short lines built to meet well defined needs such as developing valuable mineral or other natural resources and securing traffic to old-established lines. A very considerable proportion of the track laid in the first six months has been finishing work on lines on which most of the work was done in 1892. This is natural and in accordance with past experience. At present there are no very long lines under contract and probably there are not a half dozen lines on which 50 miles of track will be laid in the balance of the year. It will be observed that those states in which the legislatures have imposed the greatest burden on the railroads continue to show exceedingly small figures. The marked changes that have occurred in railroad extension are shown by the fact that in 1890 ten railroads built over 1,800 miles, or twice as much as has been built by over 70 companies so far this year. The Rock Island and the Missouri, Kansas & Texas, which have each built about 90 miles of road in completing extensions begun last year, are the only companies which have built over 50 miles of road this year, and the mileage was on two lines in each case. The Rock Island's Southern extension which has reached Fort Worth, 70 miles, is the longest line. The Missouri, Kansas & Texas is now practically completed so as to run trains into St. Louis, Mo., and Houston, Tex. Several other lines have laid some 25 miles each; these are the Wilkes-Barre & Eastern and the Buffalo, Rochester & Pittsburgh into coal regions in Pennsylvania; the Kanawha & Michigan line in West Virginia to make a through connection with the Chesapeake & Ohio; the Kansas City, Pittsburgh & Gulf, in Missouri, to reach timber; the extension of the "Soo" line to meet the Canadian Pacific; the Santa Fé, Prescott & Phœnix in Arizona; the Nevada Southern, to reach mines in California, and the Everett & Monte Cristo, to a mining district in the State of Washington. Of the lines now under construction the most interesting and important are the Bangor & Aroostook, in Maine; the Jacksonville, St. Augustine & Halifax extension along the east coast of Florida; the new Savannah cut-off of the Atlantic Coast Line; the Ohio Southern's line to Lima, O., and the Burlington line beyond Sheridan, Wyo., into Montana.

The five-hour trains between New York and Boston over the Shore Line began running on Monday last, leaving either city at 10 a. m. On the first day the trains had four cars each, and in each case one of these was a private car carrying newspaper reporters. The time was not only made with ease (the eastbound train making up 12 minutes lost by a delay west of Stamford), but it was made with the ordinary engines, with 68-in. drivers, such as are in use on the other express trains. The new 62½-ton engines, described in the *Railroad Gazette* last week, were not used. The fare by this train, including a seat in the parlor car, is $7, through, which is $1 higher than by the other limited trains. This fact has not appeared in the published announcements, so far as we have seen, but it probably explains why the Boston & Albany does not demand the privilege of running a five-hour train by way of Springfield. Since the building of the New London bridge, the Shore Line route between New York and Boston appears in the railroad guides as 232 or 233 miles long, only a mile or two shorter than the Springfield line. The speed of the new trains is, therefore, about 46½ miles an hour including the stops, and about 49 miles excluding them (five minutes each at New Haven, New London and Providence). The President of the New York & New England is reported as saying that the New Haven road has no special ground for boasting of the five-hour train; that the present 3 o'clock train, running over the New England road, travels fast enough over the eastern part of its journey to go through in 4½ hours if the New Haven road would do equally well. The time-tables hardly bear out this claim, however. The "white train" runs from Boston to Willimantic, 86 miles, in two hours and five minutes, equal to about 41.3 miles an hour. To run from Willimantic to New York, 127 miles, at this rate would take three hours and five minutes, making over five hours through. The New York Central announces that the "Exposition Flyer" between New York and Chicago will hereafter have five cars besides the dining car. As the capacity of the train before this addition was over 80 passengers, and as the advertisements now state that the train is for through passengers only, this addition of one sleeping car must be regarded as an indication that the train is thus far a brilliant success. It also shows that the locomotives have been able to make the time without difficulty. As we noted last week, the Lake Shore engineers made up an hour's lost time between Buffalo and Elkhart without any trouble. Since then other equally good runs have been made over single divisions of the Lake Shore, and by the standard engines with 68-in. drivers.

Readers interested in the car service department will have found a very good report of the recent Car Accountants' Convention in last week's *Railroad Gazette*, but Mr. Church's paper on pooling cars is good enough to appear in full, and we print it on another page of this issue. A per diem rate for interchanged cars is a vital feature of the scheme presented, and the discussion must therefore be regarded as still within the realm of speculation, for the per diem reform still sticks in the mud of conservatism and of alleged traffic necessities, very badly; but the author's thoughts are timely, nevertheless. The second point in his summary, that an effective reform (which every one sees to be possible on a compliance with a few simple conditions) would increase the available supply of cars so as to give the railroads a larger volume of freight in busy seasons, brings to mind the fact that the limited supply of freight cars is not the only hindrance when freight traffic is rushing. Locomotives are also scarce, and so are track room and elevator and storage room at terminals. It would be possible to have too many cars for economy, while still failing to answer all the demands of the howlers in times of "car famine." It is for the interest of the roads as a whole to have the fall movement of freight spread itself over as many months as possible. We do not say this, of course, to disparage efforts at reform, but merely as a slight qualification of Mr. Church's dictum. A road generally is not anxious to increase the volume of freight at any particular time except for the purpose of getting it away from some other road.

Mr. Haff's paper was also a valuable one for car service men, but we have not space for the whole of it. His main argument was given last week, and we print other extracts to-day. We expect, however, that most superintendents will demur at his cool assumption that all of the conscience is in the car-record office and none in the superintendent's office. And yet this attitude of mind on this subject is not entirely groundless. The superintendent is harassed by the demands for cars, and uses his neighbor's cars from motives that are not wholly bad; and he can shut his eyes to the evil side of the transaction so conveniently that he may soon come to do so half-unconsciously. On the other hand the car accountant not only sees every detail of the piracy that his road is committing, and realizes its enormity, but also bears the brunt of all the protests of the sufferers. Mr. Haff's plea for reform is a righteous one and should be rung in the ears of managers until it has some effect. As long as railroads depend upon each other's honor that borrowed cars shall be used with fairness and honesty, the duty is plain for each to place borrowed cars under the control of an officer who is free to give full play to his sense of fairness and honesty.

A Plan for Shop Tests of Locomotives.

The plan of Prof. James E. Denton, looking to an extended set of comparative locomotive tests, at the Purdue University plant for making shop tests of locomotives, which has been devised by Professor Goss, of that University, is one which, if carried out, will lead to results of great value to railroad companies and to locomotive builders. Not a month goes by in a locomotive building shop, or at the headquarters of a railroad company, without a confession of ignorance on the part of the mechanical experts, who govern the designing and operation of locomotives, regarding important matters relating to locomotives. Just now the all-important question is, Shall we not build or purchase compound locomotives instead of single expansion locomotives? Another is, Shall we instruct our traveling engineers to require our engine runners to keep the throttle valve open at all times while the engine is running? Other questions are: Is it best to follow some of the radical departures in valve travel and outside and inside lap? Is the Allen port an advantage for high speed? Is the double or single exhaust nozzle better for high speed? Where shall we place the exhaust nozzles with reference to the smokestack? Is there any advantage in using large hollow stays for fireboxes? Is there any real economy in using water tubes for firebrick arch supports? Is the steam delivered to locomotive cylinders dry or does it contain a too large percentage of moist-

ure? Is there a great increase of rail pressure produced by the excess of balance in locomotive driving wheels? In what manner shall a locomotive boiler be fired to give the best results with different kinds of fuel? How much fuel is wasted by the powerful draft in locomotives, and how can this waste be reduced? Is it an advantage to increase the common boiler pressure? These are a few of the many queries constantly confronting the designer of locomotives, and about which little or nothing is definitely known. Railroad men in this country have been experimenting, in the rough sort of way that is compelled by the service conditions of railroad operation, for a good many years, with a hope of settling some of these vital questions; but who can say that a single one has been definitely answered?

Professor Denton's plan is to carry on a series of accurate and scientific shop tests under the auspices of a joint committee appointed by the American Society of Mechanical Engineers and the American Railway Master Mechanics' Association to determine more definitely some of the fundamental features of operation of locomotives. The Master Mechanics' Association has agreed to find money for this purpose, and it is understood that the American Society of Mechanical Engineers will offer its support; and representative members of that Society have said they will urge the adoption of this plan at the next meeting, which will take place about Aug. 1.

If these proposed tests are carried out the results will be valuable and immediately available for all concerned. The effect would be to reduce at once the number of haphazard designs now commonly found in this and other countries. Perhaps the term "haphazard" is a little severe, as each designer is probably now working with the best light he can get; but after more definite knowledge is obtained many of the present designs might justly be termed "haphazard" if they are continued. Locomotive designing and development has been almost entirely neglected by the American Society of Mechanical Engineers in the past, and has been treated by the American Railway Master Mechanics' Association with less seriousness than it deserves. In the past, the opinions of men who are very busy about other matters and the results of a few inadequate and semi-scientific tests have been taken as gospel. Such faith as has been common in the opinions of a few bright minds may be praiseworthy under some circumstances, but the day for belief, pure and simple, is about past; and modern work, particularly in engineering, is progressing almost solely on the lines laid down by conclusions drawn from accurate information; and the time has come when locomotive building should be carried on on the same sure foundation as other engineering work.

The Committee appointed by the American Society of Mechanical Engineers two years ago consists of seven representative members, including active railroad men; this Committee, together with a similar committee, appointed by the Master Mechanics' Association, has discussed in minute detail all of the problems involved, and is unanimously of the opinion that the only way to settle definitely the essential principles of steam use in locomotives is to proceed with shop tests with the same accuracy for locomotives as has been done before and is now being done for marine and stationary engines. A perusal of the discussion of the subject by the railroad men at the Lakewood Convention will show any one that the same ideas that govern the Joint Committee are held by a majority of railroad men. Railroad companies and locomotive builders will now be called upon to subscribe a comparatively small sum of money to carry on the proposed tests, the money to be expended solely for incidental expenses, and it is to be hoped that those who will be so greatly benefited by the results will come forward and respond liberally to the requests for subscriptions to further this long delayed and necessary investigation.

The Failure of the Reading Reorganization.

It seems to be a misfortune that the plan for the reorganization of the Reading should have failed as it has. It will be remembered that the essential features of that plan were the immediate issue of $22,000,000 collateral trust bonds and a voting trust for seven years. The immediate cause of the failure is pretty generally held to have been the exacting conditions laid down in getting assents from the security holders. The plan called for assents from the holders of 90 per cent. of the general mortgage bonds within a period of about three weeks and of the holders of at least 60 per cent. of the shares within the same time. At the time the plan was put out it was said that unless these assents were given the syndicate underwriting the scheme, and representing $29,000,000, would not attempt to carry out the plan. June 21 was the last day for receiving the assents, and on that day it was found that of the necessary $40,000,000 general mortgage bonds only about $31,000,000 had assented and 410,000 shares had assented as against 480,000 necessary.

There were many persons in Wall street who from the first said that the time was too short in which to get the necessary assents, and a good deal of pressure was brought to bear to induce the syndicate to extend that time; and under normal financial conditions such an extension could probably have been had, but it was difficult from the first to organize the syndicate and agree upon a plan, and it was doubtless impossible to hold it together longer under the present conditions of the money market.

The refusal or neglect of the necessary minority to give assent to the plan was due to one of two causes, either a delay in making returns, which carried with it the possibility that such security holders were not reached, or standing out for certain specific reasons. It is credibly said that a combination of general mortgage bondholders, centered in New York, defeated the plan. Representatives of this interest have stated that they objected to the effort which was being made to reorganize the property, on the ground that it was in the interest of the McLeod management, which was the direct cause of Reading's bankruptcy. The voting trust, designed to endure for seven years, was construed to be a McLeod organization, which would either whitewash the ex-President's operations, or, by keeping them in the background, virtually outlaw them. This is one point which certain security holders are determined to circumvent. They take the stand that if there had been any irregular or illegal transaction, the security holders should have redress, and they hold that in the courts is the place to ventilate the affair. They have been led to believe that something is radically wrong by data furnished by Mr. Isaac L. Rice, who claims that he has made an official investigation of the company's affairs, covering a period of four years, from which it was shown that it had increased its net profits from $68,928 in 1889, to $3,181,487 in 1892. The bankruptcy of the road in the face of these figures makes it seem to them essential that the causes of a radical change be determined. Also that in order that security holders' interest may be protected that an investigation should be made to determine whether a plan of rehabilitation is necessary, and if so, what the nature of such plan should be.

Indications now are that the immediate requirements of the company, namely, the interest of the general mortgage bonds due on July 1, will be cared for, and that the Speyer loan will in part be taken up and in part extended; but it is becoming daily more apparent that Reading's affairs will be thoroughly sifted, and that the responsibility for its present condition will be placed where it belongs.

The Prevention of Railroad Accidents.

Colonel Haines' paper on railroad accidents, presented before the Chicago "Railroad Congress," is a very interesting review, and we print it in full in this issue. It is unnecessary for us to "point with pride", to the fact that the columns of the *Railroad Gazette* furnished the only possible source for the data summarized in this address, as the author has very courteously drawn attention to it. In analyzing the records with a view to discussing remedies, Colonel Haines wisely lays the chief emphasis on the most frequent causes of those accidents which involve the greatest possibility of danger to life and property; that is, he does not allow any one accident or any class of accidents that may be temporarily uppermost in people's minds and due, perhaps, to causes which rarely come into play, and owing their notoriety to an unusual death record, to blind him to the fact that other causes produce more accidents, and of a serious kind, and that these causes, therefore, demand chief attention. And in following out this theory, he arrives of course at the conclusion that collisions constitute our worst disgrace; and that of the three classes of these, rear collisions are the most costly and fatal. Railroad men who are in the habit of looking at our records from month to month will recognize the accuracy of this diagnosis.

In matters of opinion Colonel Haines is not only sound, but he lays stress on certain points which are often insufficiently emphasized, even by experienced railroad managers, in public utterances. The *Railroad Gazette* does not agree with him in the unqualified statement that the use of the block system is out of the question on 80 per cent. (or even on 50 per cent.) of the railroad mileage of this country, and we shall take occasion to say a word on the subject at another time; but with his main argument all careful observers must agree. Its chief points are: (1) Make outlying switches safer; (2) the trainman who is charged with the protection of a train from rear collisions must often signal following trains when his train is moving, as well as when it has been brought to a stop; (3) permissive blocking must not be confounded with the time-interval system; (4) a great improvement in inspection is necessary.

The counterweighted switch lever is a device designed to make it impossible to leave a switch set for the siding; the attendant must support the counterweight continuously while the switch is thus set. We have always urged the introduction of distant signals as the remedy for the usual disasters due to misplaced switches, as that is the simplest radical and thorough change that can be made to produce the desired effect; but such signals cost from $75 to $100 each and require regular attention; and the advocates of the counterweighted lever doubtless feel that there is a large field for it where the expense of a distant signal cannot be borne. At all events the principle is a good one; and as the device is in use on Colonel Haines' roads we must assume that he finds it valuable in practice. Whether labor-saving brakemen prop the weights up with a stick and thus evade compliance with the safety rules we do not know, but probably the lever is worth having in spite of that possibility.

The value of the fusee for use in protecting trains that are losing time has long been recognized theoretically, but in spite of this it has not come into use very widely, though it is more common than it was two or three years ago. Here again the author is speaking of his own experience, and his testimony is therefore specially valuable. This is from the highest operating officer of a road using fusees; last week we printed some equally emphatic testimony on the same point from the lowest "official" in this line, the one who knows most about fusees—a brakeman. The two combined make a strong presentation of the subject. The one great difficulty with fusees—assuming that the expense is not objectionable—is to get men to use them enough, yet not too much. As in all matters where trainmen are required to combine economy and efficiency, some will be efficient and expensive, while others will be economical, but at the sacrifice of safety.

The most valuable specific recommendation in this address is, we think, that embodied in the third of the heads we have just noted; most valuable because most needed. It deals with a feature of train running which is somewhat new in this country, and one on which mistaken views are held by a good many men who are pretty sound in other respects. The time interval is our usual system of running trains, safety from rear collisions depending upon the flagman's vigilance. Block signaling, or the use of the space interval, implies *no* dependence upon the flagman, and *this applies to permissive as well as to absolute blocking.* The object in adopting the block system is to prevent collisions; to do this, great expense is incurred, and signalmen are kept on duty day and night; but whenever it becomes necessary to substitute permissive blocking for absolute there is an inclination to return to the time interval, and most superintendents do return to it. In doing this, however, they throw away a large share, if not all, of the benefit that they ought to derive from the signalmen. The suspension of the absolute block system is necessary every week (if not every day) on most roads, but special care is needed to make sure that the trainmen know just what is put in the place of it. On a double track road permissive blocking should be necessary only near large yards, where it is very important to get trains out to relieve the pressure on switching tracks. As each outgoing train should aim to place one whole block between itself and its predecessor as soon as possible, the slow running—the necessity for which is the excuse for resorting to the time interval—becomes an advantage. If an engineman is compelled to look out for a flagman who is asleep in a caboose, instead of being allowed to expect that he will be back with his flag several hundred feet or yards, he will fall the necessary distance behind the leading train all the sooner. But on single track it is often necessary, under present conditions, to start trains as near together as possible, from one block station to another, and to have them *arrive* as close together as possible; and here the only resort is the time interval; but it is due to the trainmen that on *each occasion* they be informed of the conditions. Whether this is their due or not, there is no use denying that where the block system is used at all the men will

come to habitually place some dependence upon it and will therefore relax their vigilance in the matter of flagging; so that prudence requires that great pains be taken to show them the difference between the time interval system and true permissive blocking.

The fourth important point made by Colonel Haines will be held by many readers to take the place of all the others. It is one which has often been emphasized in these columns, and the very plain language in which the subject is spoken of in this address is good evidence that such emphasis is necessary. While no thoughtful person can think of belittling the importance of safe tracks and vehicles, the best signals and the clearest rules, it is a fact that the records of a great many train accidents have shown that in spite of doubtful tracks, old cars, insufficient signals and ambiguous rules, the accident would have been prevented by a reasonable system of inspection, and these cases are so numerous that they show how general is the need of improvement. Colonel Haines' suggestion that the railroads of this country ought to agree upon standard rules for other matters besides those embraced in the present standard code, should stand side by side with this about inspection. An inspector needs well considered rules for guidance in his work, and it is a matter of common knowledge that outside the standard code nearly every road has rules which are obviously weak. With good inspectors to keep men up to the standard of reasonable rules, a railroad can get full value out of its safety appliances, and thus perform its full duty to its patrons.

If we could admit that John Fritz is growing old we should say that it must be very gratifying to him in his declining years to get so many evidences as he does of the high place that he has won in the regard of his fellow men. But although he is now nearly 71 years old, as years are counted, he is still a vigorous young man in mind and body—erect and strong, fresh, alert and genial. So we will say that it must be gratifying to find that he has won such a place in his youth. The latest honor to come to him from abroad is the Bessemer gold medal from the Iron & Steel Institute (British), which we mentioned a week or two ago. This is regarded as "one of the greatest distinctions attainable in connection with the metallurgical arts" (Sir Frederick Abel) and is bestowed only upon men really eminent. Last year it was given to Mr. Arthur Cooper of the Northeastern Works, Middlesbrough, who has been a leader in the development of the basic steel process. The year before it went to Lord Armstrong, and the year before that to Abram S. Hewitt, both men whose names and deeds are sufficiently well known to all our readers. The Council of the American Society of Mechanical Engineers, learning that the Bessemer medal had been awarded to Mr. Fritz, has thought it worth while to record its appreciation of the compliment paid to America, to American engineering and to the mechanical branch of the profession, in which Mr. Fritz is so eminent, and the following minute and resolution were passed at a meeting held June 22, 1893.

"It having come to the knowledge of the Council of the American Society of Mechanical Engineers that the Iron & Steel Institute of Great Britain has recently bestowed upon a member and ex-Vice President of the Society the Bessemer Medal for 1893, the Council avail themselves of this occasion to tender their congratulations to Mr. John Fritz on the receipt of such a well merited and distinguished honor from his friends beyond the sea.

"The Council desires to commend the excellent judgment of the Iron & Steel Institute in selecting for this honor one who by his genius, skill and industry, through many years, has done so much toward the improved metallurgical processes, and especially in the construction of the mechanical appliances now in use in the manufacture of iron and steel in this country, as to have materially aided in making this industry the important one it now is.

"That in conferring the Bessemer Medal in this the year of our Columbian Exposition upon an American engineer the Institute has in a pleasant way added further evidence of the kindly feelings and hearty good fellowship which in so many ways has of late marked the action of engineering societies, and engineers in this country and in Europe; and we cannot but believe courtesies like this tend to a closer union of engineers in all lands; that, while it is the mission of our profession to compel the rude forces and materials of nature to contribute to the welfare and comfort of mankind, it is their mission as well to bring in closer touch nations and individuals, and in this way aiding in a degree it would seem no other profession can, to bring about those better days which in all ages past the world has hoped and struggled for."

A remarkable feature of the present situation is the continued favorable course of railroad earnings in spite of the great financial and business depression. A recent issue of the *Financial Chronicle* gave gross earnings for the month of May for 137 roads, with 95,809 miles operated. The increase in mileage over May of last year was about 1.8 per cent., and the increase in gross earnings was 8.94 per cent. For the five months ending with May 135 roads, with about the same increase in mileage, showed a gain in gross earnings of 3.8 per cent. The same week *Bradstreet's* published reports for 134 roads, giving the increase in mileage for five months as 2 per cent., the increase in gross earnings 4 per cent., and the increase in gross earnings for the month of May 9.3 per cent. It is remarkable also that these increased earnings are exhibited by railroads scattered all over the country. Important losses were shown only by the Canadian Pacific and the Columbus, Hocking Valley & Toledo. It is difficult to ascribe any special cause for the continued gains, for the heavy movement in certain staples was to a degree offset by decreased movement in others. Receipts of wheat at the principal Western markets increased very greatly, but this increase was largely confined to Chicago, Milwaukee and Duluth. The aggregate receipts of corn for the month were greater than last year also, but for the five months they were a great deal less. Receipts of oats increased heavily both in the month and in the five months, while barley and rye fell off, as did flour. It is hardly likely that the World's Fair business either in freight or passengers had much effect on the month's earnings. The *Chronicle* has also published recently a showing of net earnings for April; 131 roads show an increase of 2.11 per cent. for the month, and a decrease of 5 per cent. for the four months. The Pennsylvania reports the heaviest increase in net, and the Illinois Central the next, while the Grand Trunk, the Union Pacific, and the Baltimore & Ohio show the heaviest losses.

Corporation Counsel Kraus, of Chicago, has recently rendered an opinion on the form and validity of the ordinances for the proposed North Side Elevated Railway of that city. He decides that the city has the power to fix rates, speed of trains, determine equipment, and exercise general supervision over such roads. Mr. Kraus recommends that the city devise a system of elevated roads for its present and future needs, the specifications to be prepared and capitalists asked to build the lines. He thinks that after being built, the roads should be placed under the charge of a commission, much the same as the Railroad & Warehouse Commission, having power to control the roads within reasonable bounds. Continuing, he says: "The tendency of the times is toward control of railroads to a greater degree by the state. . . . The state has gradually assumed more and more right to regulate commercial railroads, the courts, of course, standing over to see that anything demanded is within reason, and the railroads have had to yield. The same principle of law which gives the state the right to say what the railroads within its boundaries shall do applies to municipal governments as far as intramural lines are concerned. And though these principles have never been applied in any city, I think the time has come when they should be."

We are in receipt of a 26 page 12mo pamphlet on "The Transition Curve," by Mr. E. S. M. Lovelace, M. Can. Soc. C. E., which seems simple and practicable. The curve is a function of the length of chord from the P. C. to the P. C. C. of the transition and regular curve. The easement is effected by making the radius of curvature inversely as this chord distance. The radius of the transition curve varies from the radius of the curve to be eased off to a radius of infinity where it joins the straight track; which follows from the expression of the ratio of a finite quantity to a quantity which in the limit becomes zero. A table is given which has been computed from six simple equations, derived and explained in the text. The table contains data for the location of curves from 0 deg. to 10 deg. curvature, by off sets or by deflections from the tangent. This part we would criticise by suggesting that the limits of the table were better at 5 deg. and 15 deg., instead of 0 deg. and 10 deg., for one is rarely called upon to ease off anything less than a 5 deg. curve, the necessity of easement increasing with the curvature. The pamphlet is to be recommended for its brevity and utility.

Rapid transit matters in New York City now hang fire awaiting the action of the Manhattan Elevated people on the propositions made by the Commissioners. Meantime all the Commissioners who resigned and were reappointed remain in office, except Mr. Samuel Spencer, who has definitely resigned and been succeeded by Mr. David F. Porter, of New York. We take the occasion of Mr. Spencer's retirement from the Commission to say that his conduct as a Commissioner has been marked by a sagacious grasp of the actual conditions governing a most complicated and difficult problem, and by a resolute adherence to what was necessarily an unpopular, but seems to us the only practicable, immediate solution of that problem. His courage and his firmness have been misunderstood by some people, but they will be appreciated as time goes on and as the public gradually learns the inevitable lesson of the facts. His successor is said to hold essentially the same opinions that Mr. Spencer has held; and it is said further that the Manhattan company is pretty certain to accept one of the plans offered.

NEW PUBLICATIONS.

Alternating Currents. An Analytical and Graphical Treatment for Students and Engineers. By Frederick Bedell and A. C. Crehore. 325 pp., 8vo, and 112 illustrations. New York: The W. J. Johnston Co., Lim'd. 1893. Price, $2.50.

As indicated in the title, this book is primarily intended for the use of students or others desiring a mathematical treatment of the subject. The authors have aimed to give concisely such principles as are necessary for a clear understanding of alternating current phenomena. They would appear to have accomplished their purpose well, so far as they have attempted, for although the appearance of their pages is somewhat formidable to the non-mathematical reader, they cannot be said to have entered into the phenomena of special cases as minutely as have other writers, such as Ryan, Fleming or Blakesley. In this, however, they have been wise, as there is much need at the pre sent time of an elementary treatise upon the subject, such as this is designed to be, summing up the fragmentary papers in which the knowledge of it has been heretofore found recorded. The recent advances in methods of the generation of electrical energy have been great and almost wholly in the direction of utilization of alternate currents, both for power transmission and lighting purposes. Investigations, for instance, into the properties of polyphase generation open new possibilities for alternate currents in motor work, a direction which before looked somewhat discouraging; and Tesla's beautiful experiments in the line of high-frequency currents, give promise of even more brilliant results in the solution of the lighting problem. Any work, therefore, which will enable investigators to become conversant with the underlying principles of the subject will be welcomed. The book in question can be recommended to students, or for use as a text-book, but will be found too analytical for the practical engineer or dynamo designer. No work, however, exists for the latter class of investigators; the subject, in fact, has not yet sufficiently emerged from the realm of abstract science to make such a treatment possible or exact enough to be of value.

The authors give in an introductory chapter a brief explanation of the elementary laws governing electrical and magnetic circuits and algebraic expressions for the same. This chapter is concise and admirably clear, but its purpose here is not quite apparent, as it appeals rather to the elementary student of electricity than to the more advanced investigator, for whom only the following chapters are intelligible. The main portion of the book then follows and is divided into two parts, the first being a purely analytical treatment of a single circuit, the conditions being logically introduced from the most simple case of resistance only to the more complex, dealing with the combination of this with self-induction and capacity. In all, the calculus is freely used, but the resulting expressions are quite simple.

In the second part, the subject of complex circuits, involving a network of conductors, is treated; but for this graphical methods are employed, as being less laborious and cumbersome than the analytical.

In three short appendices are given useful explanations and equations of relations between practical and C. G. S. units, and some mechanical and electrical analogies, and the book closes with an adequate index.

Galloupe's General Index to Engineering Periodicals from 1888 to 1892, inclusive; comprising Engineering, Railroads, Science, Manufactures and Trade. By Francis E. Galloupe, M. E. Vol. 2. Boston: 30 Kilby street, 1893. Price $3.

Mr. Galloupe published his first volume in 1888; that covered the period from 1883 to 1887, inclusive. The present volume, covering five years, as did the first, has about 100 more pages than that had, the total being 396. Whether or not the references are correspondingly increased in number we do not know. The author's aim has been "by the critical examination of each article to preserve references to all those of permanent technical value or practical use," and he has selected each reference by personal examination of the article. He has limited his field to 24 American and English publications, including the principal weekly and monthly periodicals and the transactions of the civil, mechanical and mining engineers' societies. There are also sixteen other periodicals incidentally indexed in part.

An alphabetical index of a little over two pages gives the principal subjects included in the Index, with reference to the pages on which they will be found. The index itself is excellently printed with a view to quick and convenient inspection. Abbreviations are used freely as well as black-faced type. Therefore, while the type is large enough to be read with ease the subjects and references are compressed into very small form.

Transactions of the Association of Civil Engineers. Cornell University, 1893.

This is the first publication of what is probably designed to be an annual, issued by the Association the title of which is given. It is a pamphlet of 126 pages, made up chiefly of lectures given by non residents before the Association last winter. These include Storm Water in Town Sewerage, by Emil Kuichling; Bridge Construction, by George S. Morrison; The Boston Water Works, by Desmond Fitz Gerald; Construction of Highways, by James Owen; Railroad Accidents and the Means of Preventing Them, by H. G. Prout; American Methods of Bridge Erection, by Frank W. Skinner. There are also two abstracts of these, one by T. W. Hill, on the Effects of Freezing on Cement Mortars, and one on Paving Brick Tests, by D. B. Clark and B. N. Moss.

Abstracts of Decisions of the M. C. B. Arbitration Committee.—This abstract is printed in a small pamphlet with a flexible cover by the *Railroad Car Journal*, of New York City. The abstract is really a synopsis of the decisions, which gives a general idea of the attitude taken by the Arbitration Committee in deciding cases brought to its notice.

TRADE CATALOGUES.

Wrought Iron Wheels—Arbel Establishments. Rive de Gier, France.

This catalogue is issued for distribution at the World's Fair. It is quite historical in character, giving a fairly complete description of the various types of wheels in use and the methods of their manufacture. The object is a comparison of chilled cast iron and steel-tired wheels with wrought iron wheels and especially with those manufactured by the Arbel Company. The catalogue first gives the early history of American wheels with statistics, data for which have been compiled from the *Railroad Gazette* and other sources. It takes up cast wheels and illustrates the different types and undertakes, from a French point of view, to show their faults and weaknesses. It then describes the manufacture of wheels with wrought spokes and cast hubs, and finally of built wheels, the parts of which are forged together under a steam hammer after the manner of drop forgings. The wheels are built like a "dished" carriage wheel, the spokes being a trifle too long, but when forged the wheel is flattened out, the spokes having been crowded into the hubs and tire and a tight fit thus secured.

The catalogue contains an account of the company's experiments with wheels that should raise the least dust, and a description of the wheel finally adopted as a result of those experiments, it being a combination of spoke and disc wheel, which is termed a "ribbed disc wheel."

Considerable space is devoted to an investigation of the stress in the members of different wheels for the different conditions to which they are subject and a comparison of the strength of the spoke, the disc, and the ribbed wheel is made. These results are then compared with those of practical tests made. The tests are tabulated and engravings made of wheels that were tested, showing breakages.

Much can be learned of car wheels by a careful perusal of this catalogue and such a historical and scientific treatise should commend itself to manufacturers of this country as a very honorable and successful way to favorably introduce their goods to the attention of consumers.

Railroad Matters in Chicago.

World's Fair Traffic.—The rush of visitors to the World's Fair continues to increase, and during a portion of the past week many of the roads found their carrying capacity taxed close to its limit. The General Manager of the Chicago, Rock Island & Pacific said: "We are compelled to divide our trains and run them in sections, and at the rate our business is growing it will soon be a question of ability to supply cars. Even now our sleepers are insufficient for the demand, and the Pullman company is unable to furnish an increase." The Chicago, Burlington & Quincy, which, as stated in a recent letter to the *Railroad Gazette*, added 175 coaches to its already large equipment, report that the demand is rapidly nearing its ability to supply; and similar statements come from the Chicago & Northwestern, Chicago, Milwaukeee & St. Paul and other lines. The St. Paul people state that nearly every day-coach is in commission, and their sleepers are inadequate to the demand. When asked in regard to a prospect of further reduction in rates, General Manager Earling said: "I see no use in reducing rates while people are coming here in such numbers that it will soon be a question of furnishing transportation. Current rates are also lower, and we have little complaint, except from a class who are never satisfied with any price."

The Governor of Kansas has addressed letters to managers of all railroads in Kansas asking them to make lower rates to Chicago for World's Fair visitors. He also asks that, if the roads cannot make general reductions, they make special excursion rates. The manager of one of the lines says that the latter will probably be done later on, when the railroads are well convinced that the farmers are ready to come. But he saw no object in an immediate move in that direction.

An officer connected with the General Passenger Department of the Atchison, Topeka & Santa Fe said: "Our business is large and increasing, but we still have a large number of unemployed coaches which we would like to see in service. The trouble is that a very large majority of the people along our Kansas lines are strongly impressed with the idea that they should have much cheaper rates than have yet been made; hence they are holding back for a reduction. I do not think they will come at more than one fare for the round trip, and even at that rate many would grumble. We are tied up by the agreement of the association to which we belong, and cannot lower rates without the consent of all the association roads. If they would consent to make excursion rates at say one fare for the round trip, and run excursions once or twice a week, we would bring in very long trains. This would not disturb regular tariff rates, and at the same time remove much of the existing complaint."

The General Manager of another line said: "The present rates are low enough. The people of Kansas are a lot of whiners. Nothing the railroads have ever done, or can do, pleases them. I think, though, that inasmuch as A., T. & S. Fe has the most extensive mileage in the state, it should be allowed to arrange a system of excursions at, say, one fare for the round trip, but I am not in favor of the movement just now. The other roads in the association are too busy providing for a more profitable traffic; therefore have neither time nor rolling stock for such excursions at present." The same views were expressed by an officer of another road, who added that his company was not largely interested in Kansas, but had all the track there it wanted. The Eastern and Southeastern lines have all signified their intention to run excursion trains when the demands justify, and some are already experimenting in that way. It is said, however, by those who have watched the movement closely, that there is little profit in such trains. As one party put it: "The roads thus engaged are trying to invite a call for excursions instead of waiting for a legitimate demand from the public, and until the latter appears such extra service is neither profitable nor politic." The same sentiment seems to prevail among the other roads, but, as already stated above, it is a question with lines whose equipment is employed with regular business how they can go extensively into the excursion business. It is proper to assume, however, that as yet the farmers have not made any formal request for favors, but when they do so the roads will make extra excursions to comply with their wishes, though the tickets will be limited to short dates.

Freight.—The freight traffic of the Western railroads the past week was irregular, some lines showing good gains over the one immediately preceding, while others exhibited a shrinkage. Comparing the grain deliveries there was an increase of 394,000 bushels, but a decrease of 1,784,000bushels from the week ending June 25 last year. In mixed produce, however, the increase over last year was 6,426 tons. With few exceptions the managers said that the aggregate earnings on in-and-out freight were larger than last year. The continued improvement in crop advices from about all sections of the grain belt also encourages the railroads to look for a large autumn traffic.

The following shows the receipts of flour and grain at Chicago by each of the granger roads for the week ending June 24 for two years:

	1893.		1892.	
	Flour.	Grain.	Flour.	Grain.
C. & N. W	16,376	464,000	15,183	1,252,000
Ill. Cent	1,800	799,000	560	358,000
C., R. I. & P	4,250	867,000	5,000	923,000
C., B. & Q	5,529	901,000	9,303	1,456,000
C. & Alton	150	128,000	2,350	162.000
C. & E. Ill	450	63,000	.....	59.000
C., M. & St. P	16,050	517,000	17,975	676,000
Wabash	300	122,000	3,465	125,000
C. Gt. W	9,332	109,000	14,535	381,000
A., T. & S. Fe	4,300	196,000	230	529,000
Wis. Cent	170	1,000	3,575	.....
Totals	58,707	4,167,000	72,176	5,921,000

It will be seen from the above that the Chicago & Northwestern and the Chicago, Burlington & Quincy suffered the largest shrinkage in their grain traffic, the loss of the former being 788,000 bushels, and of the latter of 556,000 bushels. On the reverse the Illinois Central more than doubled on last year's business. The aggregate movement of live stock showed a slight increase.

Earnings and Expenses.—In a recent letter attention was called to the fact that although the April and May earnings of the railroads centring here from the agricultural districts would compare well with those for the corresponding month in 1892, the operating expenses were lighter because of the lessened costs for track, bridge and other repairs caused by high water, which figured so largely in last year's expense account of about every railroad west of the Alleghanies. Further investigation discovers that the present year's charges were much lower than at first supposed. The managers of a number of the largest lines traversing Illinois, Wisconsin and the states west of the Mississippi River agree that, notwithstanding portions of their roads were at times subjected to heavy rains and high waters, very little damage occurred either to roadbeds, culverts or bridges, whereas the repair charges on the same sections last year were enormous. An ex-railroad manager, when asked his opinion regarding the question of operating expenses the current and past year, said: "Unless the roads improperly charge outlays for extra equipment to operating account, they should show much higher percentage of net earnings this year. When the roads repaired the flood damages last year they, as a rule, did their work substantially. Tracks were solidly built, and culverts constructed with greater discharging capacity. Many wooden bridges which had been rendered unsafe were either rebuilt more substantially than before or replaced with iron and steel structures. The outlays were heavy, and as they were in the main placed to operating account the showings of net earnings was very small, but the small charges incurred for washout and flood repairs the past spring proves that the officials were wise. The great trouble has heretofore been that the majority of the railroads saved in the wrong place, *i. e.*, they paid too much attention to show and advertising, and too little to substantial work, but they are becoming wiser and will build better in the future."

Another subject just now attracting the attention of railroad men is the grade question. The ability of the Lake Shore road to earn dividends at the very low figures received for carrying freight is mainly attributed to the fact that its maximum grade is only 16 ft. per mile. This lessens the cost for motive power, and the wear on the track is less than on steep grades.

New Work and Betterments.—Some weeks since it was stated in some journals that the Chicago, Milwaukee & St. Paul had laid a new second track with 92 lb. rails between Chicago and Milwaukee. The statement as to the second track was correct, but the weight of the rails should have been 75 lbs., which is the weight of all the new rails being put down by the company. In addition to the track to Milwaukee a double track is being built on the Mississippi Division of the road from Pacific Junction, just outside of Chicago, to Savannah, on the Mississippi. At present only 45 miles of track will be laid. This, however, will make 81 miles of double track, 16 miles having previously been put down at an intermediate point and 20 miles at the Savannah end.

The Chicago, Rock Island & Pacific is relaying about 30 miles of old track with new 75 lb. rails. In many cases the rails which are being replaced are but partly worn and will be utilized on spurs and sidings. The manager states that a large amount of additional siding is found necessary to enable the system to handle its growing traffic to advantage.

The Chicago, Burlington & Quincy will put down between 25,000 and 30,000 tons of new 75 lb. rails within the remainder of the year. It will also reuse a large amount of old rails taken up, in sidings and so forth. The Manager says it is good economy to keep their main track in the highest condition possible; hence rails which are not above suspicion are replaced with new ones, and those taken up relaid where less service is required.

As far as can be learned all the new rails being put down by the leading Western roads weigh 75 lbs. The Illinois Steel Company states that the only 90 lb. rails rolled at their mills within the past six months were for the Metropolitan City Railroad, and it seems to be the opinion of officers that 75 lbs. will be the immediate future standard on the granger roads. A curious illustration of the change in the weight of rails within two decades may be found in the fact that, when at the end of 1870 General Fremont imported a large invoice of 70 lb. steel rails from France for the projected Memphis & El Paso Railroad, the weight was considered extravagant, and especially so as the cost of the rails was $106 per ton of 2,240 lbs. at New Orleans. At that time 56 lbs. was considered amply heavy, and after the collapse of the Memphis & El Paso scheme the 70 lb. rails were hawked about and finally sold to the St. Louis, Iron Mountain & Southern Railroad, then in course of construction. The purchase was considered unwise, and some engineers said that such weights could only be used to advantage on very heavy grades. At present there are few engineers who would advise less than a 70 lb. rail for roads having heavy traffic, and a very respectable number favor 80 to 85 and a few 90 to 100 lb. rails except for roads with very light grades and few curves.

Elevation of Tracks.—The City Council took a fresh start on the elevated track question a few days since General Manager Earling, of the Chicago, Milwaukee & St. Paul road, was summoned before a committee of aldermen appointed to confer with the railroad officials on the question of elevating tracks. Manager Earling, after showing that if the City Council desired it could make Chicago the most handsome city in the world by merely driving out the railroads and manufacturing establishments located along their tracks, told the committee that their city would be as noted for its poverty as its beauty, because its only means of support were gone, and it would perish for want of sustenance. As a remedy for the many accidents and loss of life at the crossings he advised a system of interlocking switches, which he said would render accidents next to impossible unless the victims intentionally ventured in front of a moving train. His suggestion was objected to by one of the brilliant aldermen because it would, as he expressed it, be temporizing with the ordinance requiring the roads to begin at once the work of track elevation. Finding that the committee was deaf to all argument he told it that no road entering in Chicago had the money to defray the cost of track elevation as directed in the O'Neil ordinance, and had no means of obtaining it. He also informed them that if the work was commenced it would require at least five years to complete it. Although Manager Earling did not indicate what action his company will take in case the city seeks to enforce track elevation, it is generally understood that the St. Paul will unite with all the other roads and contest the question in the courts. They will also be joined by the manufacturers, coal and lumber yards, and other large establishments that would be ruined by track elevation as proposed. The proprietors of these concerns say that they have invested millions of dollars in real estate and plant for the purpose of securing the cheapest means of concentrating raw materials and distributing finished product in every direction, and they do not propose to allow their interest to be destroyed for the benefit of a syndicate of speculative adventurers who

there are strong reasons for believing, secured the passage of the elevated track ordinance in anticipation of selling the railroads a system of track elevation for which they hold the franchise.

CHICAGO, June 26, 1893.

The Course of the Railroad Bond Market During the Year.

We present below a carefully prepared table showing by groups the course of railroad bond prices from Jan. 1 to June 17 (in a few cases June 19), giving the month during which the highest price was reached, the lowest price, and the date and price of the last sale. The supplementary tables give the average decline by groups, from the highest to the lowest, and from the highest to the latest date. The course of the stock market during the period treated is also given in order to show the relation of investment bonds to stocks. The table shows that the majority of bonds sold at their highest prices during January and February. The lowest prices, as a rule, instead of following immediately upon the May panic, did not come until the latter part of May or the first part of June. This shows that the bonds, particularly the better classes, did not decline in proportion to the downward movement in the stock market, but reached their lowest value in the liquidation which followed. This is almost invariably the case with investment securities.

A point worthy of note is the very staple quotations of the first mortgage bonds as compared with junior securities of any individual property, indicating that a first lien on the railroads is, generally speaking, regarded as a "gilt edged" security. There are of course exceptions to this rule, notably in those first mortgage bonds of roads which were insolvent or threatened with a receivership. Notable examples of this will be found in the Richmond Terminal, Reading, Missouri Pacific, Toledo, Ann Arbor & North Michigan, and Tennessee Coal & Iron senior securities. On the other hand certain roads whose junior securities showed a pronounced weakness received strong support for their first mortgage bonds. Thus Richmond & Danville 6's declined but 8 points, Reading general mortgage 4's 21 points against 40 and 50 points in the first, second and third mortgages; New York, Susquehanna & Western 1's 1½ points against the 2's 7 points, Northern Pacific first 6's 3 points against the 2's 6 points, and the consolidated mortgage 16 points.

An interesting table is that of the average decline of the various groups. The trunk lines show the most stable condition and the quickest rally from the lowest point; the grangers follow with a less rapid rally. The Southern roads are third, and the coal roads, the last important group, fourth. The miscellaneous, showing the biggest decline, is not particularly significant in reflecting the course of the market as a whole. The table follows.

	Average greatest decline.	Average greatest decline to last sales.
Trunk lines	4⅝	2⅛
Southern roads	10¼	8
Coal roads	16⅜	15⅛
Grangers	6⅜	5¼
Miscellaneous	27⅜	25

The Trunk Line group, which leads the list in point of stability, had its averages reduced by the weakness in New York, Lake Erie & Western securities. These, and particularly the seconds, declined upon a report that the company had a large floating debt and was going into the hands of a receiver. The rally of about 3½ points from the lowest was upon assurances from officers of the company that it was doing as well as could be expected under the circumstances.

In the Southern group, the decline over the period of review, while pronounced, was by no means the net decline. The Richmond Terminal reorganization plan, put out over a month ago, failed to materially affect the better class of bonds. The conditions which prompted it had been fully discounted in the liquidation which took place last year. In a general way this can be said to be the case with values throughout the South. That section is not at present suffering as severely from the financial depression as is the West. The cause is to be found in the fact that the deflating process started in after the Baring panic, and the liquidation has continued up to the present time. The bonds of the Richmond Terminal system fared much better than did the stocks, as will be seen by the accompanying stock table. This is due to the very drastic measures of the Richmond Terminal reorganization plan, which, on the whole, favored the bonds by being particularly severe on the stocks.

The average decline in the coalers was materially increased by the bankruptcy of the Reading company. The four classes of bonds sold as low as they have at any time since the reorganization, and are to-day quoted at the lowest figure. Barring the Reading group, the average would have compared very favorably with that made by the grangers.

The granger group had its average decline increased by the weakness of Atchison, Northern Pacific, Missouri Pacific and Wabash. Atchison's 4's and incomes dropped during this month on the rumors that the company had a larger floating debt than was generally known. The prompt assertions of President Reinhart to the contrary turned the market toward a rally, and at the present time these securities are stronger.

Northern Pacific securities show the most pronounced declines of the granger group, especially those of the junior order. The consolidated mortgage 5's fell on rumors of the bad condition of the property as reflected in decreases in earnings, and a possible default in interest. Upon the announcement of the plan for funding the floating debt they rallied about seven points from the lowest. Missouri Pacific bonds fell in sympathy with a decline in the stock, and scoring their greatest drop about the time the bear traders promulgated the story that the company had a very large floating debt and was not earning all its fixed charges. They are at present selling at the lowest figures of the year and are very weak.

The special declines in some of the better classes of granger securities are noted and accounted for as follows: Burlington bonds fell three points about two months ago on the selling of bonds held in the sinking fund. The consol 7's had a partial rally. The dealings in the St. Paul and Northwestern bonds were very light. The drop was in sympathy with the rest of the market. A majority of the declines in the granger bonds were either out of sympathy with the drop in the stock market or liquidation for investment account.

In the miscellaneous group are included two insolvent roads, viz: The Toledo, Ann Arbor & North Michigan, which defalted on its bond payment, and the Toledo, St. Louis & Kansas City. The decline in Oregon Improvement 5's of some 19 points was principally on liquidation. The company is perfectly solvent and is now doing well. The Tennessee Coal & Iron securities closely followed the course of the stock market, which is shown in the accompanying table, and which scored a decline of some 21 points in the common stock. The cause of this is well known being in the gigantic stock jobbing deal which resulted in the shaking out of the De Bardelaben interest by a New York syndicate, which now has control.

It is interesting to note the the extent of the decline in that class of bonds that are regarded as gilt-edged. Government bonds during the present liquidation have dropped about two points, and in addition are selling extwo per cent. interest not yet due, owing to the forced sales by holders who required capital for industrial purposes. In contrast with this drop, New York Central 4's declined 3¼; Lake Shore first 7's, 2; Michigan Central firsts, 5; Canada Southern, 1½; Pennsylvania 4½'s, 3½; Jersey Central, 7's, 2½; Northwestern, 7½; Rock Island 6's, 5; St. Paul Consolidated 7's, 4; Union Pacific Sinking Fund 8's, 3⅝; Illinois Central 4's, 4½.

The declines in the stock market over the period under review are given in an accompanying table, the averages being as follows:

	Average greatest declines.	Average greatest declines to last sale.
Trunk Lines	11⅝	8⅝
Southern roads	10¾	8½
Coalers	23⅛	21⅛
Grangers	15⅝	13
Miscellaneous	19⅜	17⅝

In comparison with the average declines of the bonds, the stocks show a movement over a wider downward range. This can be attributed in a measure to the fact that an active security always suffers to a greater extent than an inactive one in a panicky market. This is especially the case with the trunk lines, the stocks of which have declined 6¾ points more than the bonds. The comparison between the stocks of Southern roads and bonds shows the declines to be about the same. This can be attributed to the fact that liquidation was well under way before the opening of the year, as noted above. The coalers follow the trunk lines, while the granger stocks, in which the greatest activity on the Exchange is centred, show a decline of 9¼ per cent. greater than the bonds.

The accompanying table shows the course of the stock market:

	Highest.		Lowest.		Last sale.	
Trunk lines:						
New York Central	Jan.,	111½	May,	98	June 19,	102¾
Lake Shore	April,	134½	May,	118¾	June 19,	123⅜
Michigan Central	April,	108½	May,	96	June 16,	97
Canada Southern	Jan.,	58¾	June,	49	June 19,	50⅞
Pennsylvania	Jan.,	55½	June,	50	June 19,	50⅞
Erie	Jan.,	26⅝	June,	16¾	June 19,	17⅜
Southern roads:						
Richmond Terminal	Feb.,	12	June,	⅞	June 19,	2
East Tenn., Va. & Ga.	Feb.,	5⅞	June,	¼	June 19,	¼
Louisville & Nashville	Jan.,	77⅝	June,	61¾	June 19,	67⅝
Coalers:						
Jersey Central	Jan.,	132¾	May,	104½	June 19,	107½
Reading	Jan.,	53¾	June,	15½	June 19,	16⅜
N. Y., Sus. & Western Pfd	Jan.,	73⅜	June,	53	June 16,	56
Ontario & Western	Jan.,	19¾	May,	14¼	June 19,	15⅛
Grangers:						
Chicago & Northwest	Feb.,	116⅜	June,	104	June 19,	101½
Rock Island	Jan.,	89⅜	May,	68	June 19,	72⅝
St. Paul	Jan.,	83½	June,	66½	June 19,	69¼
Atchison	Jan.,	36½	June,	22¼	June 19,	23⅝
Burlington	Jan.,	103⅞	May,	81¾	June 19,	87⅝
Northern Pacific Pfd	Feb.,	50⅜	June,	31⅞	June 19,	34⅝
Union Pacific	Jan.,	42⅝	June,	27	June 19,	29⅝
Denver & Rio Grande Pfd	Jan.,	57¼	June,	45⅞	June 19,	49⅛
Missouri Pacific	Jan.,	60	June,	33½	June 19,	30⅛
M., K. & T. Pfd	Jan.,	28⅜	May,	19½	June 19,	20¾
Wabash Pfd	Jan.,	28⅜	May,	15½	June 19,	17½
Illinois Central	Jan.,	104	June,	87½	June 19,	93⅛
St. Paul, M. & Manitoba	Feb.,	116¾	June,	108	June 19,	108½
Miscellaneous:						
Toledo, A. Arbor & N. Mich	Jan.,	40½	May,	7¼	June 19,	10
Oregon Imp	Feb.,	21½	Feb.,	18	*Mar. 1,	19⅞
Tenn. C. & Iron	Jan.,	37⅜	May,	16½	June 19,	16¾

* June 22 this stock sold at $10. There were no intervening sales.

Following is the bond table:

Name of Road.	Highest.		Lowest.		Last sale.	
Trunk lines:						
New York Central:						
4th deb. ext	Mar.,	103	June,	99¾	June 16,	99
1st coupon 7's	Feb.,	124	Jan.,	121¾	May 25,	123
Deb. 5's, coupon	Jan.,	108½	Mar.,	106	June 8,	106¾
N. Y. & Harlem	Feb.,	119½	May,	115	June 6,	118½
R., W. & Ogd. con. 5's	Feb.,	115	June,	110	June 16,	110
Lake Shore:						
1st con. 7's, coupon	Jan.,	119	June,	117	June 7,	117
2d " " "	Jan.,	122½	June,	118	June 13,	118
Michigan Central:						
1st con. 7's	April,	122½	May,	117½	June 16,	117¾
Consol. 5's	April,	106¾	May,	104½	June 14,	105½
Canada Southern:						
1st guar. 5's	Feb.,	107½	Jan.,	105	June 17,	106
2d 5's	Jan.,	103½	June,	99	June 16,	100¼
Pennsylvania:						
Bond 4½'s, coupon	April,	110½	Jan.,	106	June 14,	108½
N. Y., L. E. & Western:						
1st con. 7's, g	Jan.,	139½	June,	130½	June 14,	130½
Long Dock con. 6's, g	Feb.,	125	Jan,	122	May 18,	123
2d con. 6's, g	Feb.,	105	June,	89⅝	June 15,	93
Chicago & Erie income 5's	Feb.,	103½	May,	95	June 16,	97½
Chicago & Erie 1st 4·5's, g	Jan.,	44¾	June,	35	June 16,	36
Southern roads:						
R. & W. P. Terminal:						
Trust 6's g	Feb.,	83⅞	May,	56	June 9,	59¼
Con. 1st & Col. T 5's, g	Feb.,	52	June,	24½	June 16,	26½
E. Tenn., Va. & Ga.:						
Con. 5's, g.	April,	94	May,	90	June 17,	91½
Knoxville Ohio 6's g	Feb.,	101½	Jan.,	100	June 8,	101
Richmond & Danville:						
Con. 6's g	Feb.,	111	Jan.,	103	June 14,	107½
Con. 5's g	Mar.,	78¼	Jan.,	67	June 13,	74½
Central of Georgia:						
Sav. & West 1st con 5	Jan.,	70¼	May,	50	May 22,	51
Louisville & Nashville:						
Bond con. 7's	Jan.,	113	June,	108	June 16,	108⅞
N. O. & Mob. 1st 6's g	April,	123½	Jan.,	119	June 17,	119¾
" " 2d 6's g	Feb.,	110	Apr.,	108	June 8,	108⅝
Gen. 6's g	April,	119⅝	June,	115	June 17,	115¼
Unified 4s 'g	Feb.,	83½	Jan.,	80¼	June 16,	82
Coal Roads.						
Central of New Jersey:						
Consol 7's, 1899	Mar.,	116	Apr.,	113½	May 17,	114
Consol 7's, 1902	Feb.,	122	May,	118	June 7,	118
General Mortgage 5 g.	April,	112½	Jan.,	108⅞	June 15,	110½
Philadelphia & Read'g:						
General 4's g	Jan.,	85¼	June,	66	June 16,	66
1st pref. inc. 5 g.	Jan.,	76⅞	June,	30½	June 17,	30¼
2d pref. inc. 5 g	Jan.,	70	May,	21	June 17,	22
3d pref. inc. 5 g.	Jan.,	62⅜	May,	16	June 16,	¾
N. Y., Sus. & Western:						
1st refund. 5 s g	Mar.,	107½	June,	105	June 14,	105
Midland of N. J. 6's g	Mar.,	120½	May,	113½	June 15,	114¼
New York, Ont. & West.:						
Refunding 4's g.	Feb.,	86½	Mar.,	82	June 15,	82
Consol 1st 5 g	Jan.,	108½	June,	103½	June 16,	104¼
Grangers:						
Chicago & Northwest:						
Consol 7's	Jan.,	138	June,	130½	June 7,	132
Coupon gold 7's	Mar.,	123	June,	119	June 6,	119
Sinking fund 6's	Feb.,	115	May,	110¼	May 6,	110¼
" " 5's	Jan.,	109	Apr.,	106	June 8,	106¼
" " deb. 5's	Feb.,	112	Jan.,	106¼	May 10,	108⅛
25 yr. deb. 5's	Mar.,	106	June	100	June 9,	101
Extension 4's	Jan.,	98	Apr.,	94	June 12,	94
Chicago, R. I. & Pac.						
6's coupon	Jan.,	125	Jan.,	120	June 15,	123
Extension & col. 5's	Feb.,	101⅞	May,	98	June 17,	99½
30 yr. debent 5's	Feb.,	97½	May,	90⅝	June 9,	91½
Chicago, Mil. & St. Paul:						
Con. 7's	Apr.,	129	Feb.,	125	May 17,	125½
1st Southwest div. 6's	Apr.,	114¾	June,	109½	June 16,	109½
1st So. Minn. Div. 6's	Feb.,	116½	May,	111	June 16,	112¼
1st C. & P. W. Div. 6's	May,	112	Jan.,	108¼	June 17,	109½
C. & M. Riv. Div. 5's	Apr.,	105	Jan.,	102½	June 10,	103½
Wis. & Minn	Apr.,	108	Jan.,	105	June 14,	107½
Terminal 5's g	Apr.,	108½	Jan.,	105½	June 29,	107½
Gen. M. 4's g series A	Apr.,	95	Jan.,	80½	June 16,	93
Mil. & Nor. 1st con. 6's	Feb.,	115	June,	110	June 16,	110
Atchison, Top. & S. Fe:						
100 year 4's	Feb.,	83⅞	June,	78	June 17,	80
2d 2½—4's g class A	Jan.,	57⅛	June,	44½	June 17,	47
Chic., Bur. & Quincy						
Consol 7's	Apr.,	121½	Mar.,	117½	June 14,	119
Debenture 5's	Jan.,	102¾	May,	98½	June 10,	98
Convertible 5's	Jan.,	108¼	June,	100	June 15,	100⅞
Denver Div. 4's	Jan.,	94¾	June,	88½	June 13,	90
Nebraska Ext. 4's	Jan.,	88⅞	June	84½	June 14,	84⅝
Northern Pacific:						
1st coupon 6's g	Feb.,	118	May,	115	June 13,	116⅜
Gen. 2d coupon 6's	Feb.,	115	June,	109	June 16,	109¾
Gen. 3d coupon 6's	Feb.,	108	June,	101¼	June 16,	102
Con. Mort. 5's g	Feb.,	74	May,	58	June 17,	63
Chic. & N. P. 1st 5's g.	Feb.,	80½	June,	66	June 14,	71
Seattle, L. S. & E., 1st 6's	Jan.,	92¾	June,	81½	June 2,	81½
Union Pacific:						
Sinking fund 8's	Feb.,	105⅝	Mar.,	101	June 15,	102¼
Collat. Trust 4½'s	Jan.,	73	June,	60	June 16,	60
Gold 6's Col. T. notes	Jan.,	102¾	May,	95	June 16,	98¾
Kan. Pac. 1st con. 6's g	Apr.,	112½	June,	103¾	June 15,	104
Oregon Short line 6's g	Jan.,	109	May,	100	June 9,	101½
Or., S. L. & U. N. con. 5's g	Jan.,	80¼	June,	65½	June 15,	67
U. P., Den. & Gulf con. 5's g	Jan.,	75⅝	May,	66⅜	June 16,	69
Denver & Rio Grande:						
1st 7's g	Apr.,	119	May,	114½	June 16,	115
1st consol. 4's	Feb.,	88½	Jan.,	84	June 17,	85½
Missouri Pacific:						
1st con. 6's g	Mar.,	113	June,	102	June 8,	102
Third 7's	Apr.,	115½	June,	105	June 16,	105
Pac. of Mo., 1st ex. 4's g	Jan.,	102	Apr.,	98½	May 29,	99
Pac. of Mo. 2nd ex. 5's	Jan.,	103¼	Jan.,	106½	June 9,	107½
Iron Mt., G. Ry. & L. G. 5's g	Jan.,	90¾	June,	80	June 12,	80
Missouri, Kansas & Texas:						
1st 4's g	Feb.,	82¾	June,	77¾	June 17,	78¾
2nd 4's g	Jan.,	50½	May,	40⅝	June 17,	43
Wabash:						
1st 5's g	Apr.,	106½	May,	100	June 17,	100½
2nd mort. 5's, g	Jan.,	82½	May,	71	June 16,	72⅜
Deb. mort. series B	Jan.,	39	June,	25	June 16,	26
Illinois Central:						
4's gold	Mar.,	105	Jan.,	100½	June 12,	100¾
St. Paul, M. & Man.:						
Dak. ex. 6's g	Apr.,	119½	May,	115	June 5,	116
1st consol, 6 s g	Mar.,	123½	May,	118	June 13,	118¼
1st consol reduced to 4½ g	Apr.,	103¼	Jan.,	100	June 5,	103
Montana Ext. 4's g	Jan.,	91	Jan.,	88	June 13,	88½
Miscellaneous:						
Toledo, Ann Arbor & N. Michigan:						
1st con. gold 5's	Apr.,	93	May,	30	May 26,	30½
Toledo, St. L. & K. C.:						
6's gold	Jan.,	90½	June,	59¾	June 17,	59¾
Oregon Imp. 5's	Feb.,	67	May,	48½	June 16,	51⅞
Tenn., C. I. & R. Tenn. D. 6's	Feb.,	95	May,	80	May 29,	80
Tenn. C. I. & R. Birm. D. 6's	Jan.,	95½	June,	83	June 3,	83

The last week, ending Monday night, was a trying one for the bond market, which showed unmistakable signs of further liquidation. With money ranging from 6 to 30 per cent., and hard to get at those figures, it is not surprising that resort was had to strong boxes, and that securities in comparatively large amounts have been taken therefrom and thrown upon the market. As evidence of this, we note a decline in 30 different classes of bonds. The depreciations are as follows: Northern Pacific 1's, 1; consolidated 5's, 2; Ontario & Western consolidated 5's, 1½; Oregon Short Line consolidated 5's, 2; Oregon Improvement 5's, 3; Pittsburgh Western 4's, 1; Rock Island 5's, 2; Atchison 4's, 1¼; 2's A1, ¾; Chesapeake & Ohio consolidated 5's, 2; 4½'s, 2¾; Burlington convertible 5's, 1¼; 7's, 1½; Canada Southern first 5's, 2; Colorado Midland 4's, 2; Denver & Rio Grande 4's, 1¾; Erie 2's, 1¼; M., K. & T. 4's, 1¾; 2's, 2; Rio Grande Western 1's, 2¼; Texas Pacific first 5's, 2⅛; Toledo, St. Louis & Kansas City 1's, 1½; Union Pacific g. 6's, 3; Union Pacific, Denver & Rio Grande 1's consolidated, 7; Wabash 2's, 1½; Wisconsin Central, 1's, 5. It is in the Reading group that most pronounced declines are noticeable. Thus the first incomes declined 1¼, the 2's, 3; the 3's, 4, and the general mortgage 4's 1½. These deprecations are not as large as some others in the list, but in this connection it must be considered they come on top of very pronounced declines as shown in the above table. They were due to the failure of the Reading plan.

Railroad Construction in 1893 to July 1.

The preliminary reports of track laid in the United States between Jan. 1 and July 1, 1893, give the new mileage as 896 miles, which will probably be increased by revised figures made after July 1. In a later issue will be published a detailed statement of the lines on which track has been laid in 1893. We publish below a tabulated statement, by States, from the records which we have now received:

Alabama	16	New York	40
Arizona	41	North Carolina	34
California	31	North Dakota	28
Colorado	12	Ohio	36
Florida	55	Oregon	3
Georgia	35	Pennsylvania	85
Idaho	3	Rhode Island	5
Illinois	40	Tennessee	5
Indiana	7	Texas	123
Kansas	9	Virginia	7
Kentucky	19	Washington	33
Louisiana	4	West Virginia	53
Maine	2	Wisconsin	9
Massachusetts	2	Wyoming	8
Michigan	1		
Minnesota	19	Total, United States	896
Mississippi	1	Canada	64
Missouri	106		
Nebraska	22	Grand total	960
New Jersey	2		

The Car Accountant—A Misnomer; His Ultimate Elevation.*

What is the proper sphere of the car service officer? Is it to merely keep and be responsible for records of car movements? Is it to become an expert bookkeeper of car mileage accounts? I contend that it is possible for the car service man, if he be made of the right stuff, to throw off the shackles of the mere drudgery of record work and step out into a wider sphere of usefulness and power; establishing close relations with the general superintendent or general manager, commanding their respect and relieving them entirely of a burden they are now compelled to bear, simply because, in so many instances, there seems to be no other shoulder capable of bearing it. Upon his shoulders should be placed the sole responsibility for car performance and supply, and upon every question concerning equipment his ruling should be supreme. This is the legitimate, the ultimate, sphere of the car service man. The man who is content with anything less is not worthy of that which he already possesses. It should be the paramount aim of this Association to see its members elevated to this standing in the operating department. . . . There should be no feature of the transportation department with which we should not become entirely familiar. *Everything* pertaining to transportation on our respective roads should be thoroughly mastered. As a matter of course we are supposed to have a thorough knowledge of our own equipment, and that is certainly indispensable, but we do not all possess this knowledge. We should have almost a personal acquaintance with every car, certainly with every *class* of cars, both passenger and freight. The entire train service, both passenger and freight, should be as well understood by the Superintendent of Car Service as by the head of the train department himself. He should be thoroughly familiar with the needs and resources of the train service; thoroughly familiar with existing and the manner of making up new schedules; thoroughly familiar with the requirements of the traffic at all seasons of the year, with the physical conditions of the line, its trackage capacity at all points, etc.

In closing this paper, I desire to refer to car service associations. They are doing a grand work. Their efficiency in breaking up the practice of consigning cars "to order" around the great centres of trade must not be underestimated. That they have been the means of giving a wonderful impetus to the movement of cars wherever the rules have been enforced cannot be disputed. But they have not gone far enough and never can in their present shape. A glance at the map recently issued will show how utterly insignificant is the field they cover in comparison with the entire railway mileage of the country. They certainly do a great work in the vicinity of the large cities where the major portion of the associations confine their operations; but it is only toying with the trouble to force the release of all cars promptly at these central points and wink at the inordinate detentions of thousands of cars everywhere else. The cry has been voiced that the car service associations are not accomplishing the purpose for which they were created, and that a decrease in car detention is not perceptible since their organization and operation. This cry is utterly false in so far as it applies to the territory actually covered; but go beyond the circle of the associations' influence and it becomes, of course, entirely correct. If the rules are good for the cities and heavy transportation centres, they are good for the less important localities as well. If they are effectual for a portion of the line, they are expedient for each and every line in its entirety; and it is our province, as superintendents of car service, to urge their adoption throughout the length and breadth of the country.

* Extracts from a paper by Frank E. Haff, of the Long Island Railroad, read at the Indianapolis Convention of the Car Accountants' Association, June 20, 1893.

The Limited Pooling of Box Cars.*

During a recent shortage in the car supply the Pennsylvania lines telegraphed to one of its largest immediate connections running from Cincinnati to the South: "You have 400 of our cars on your line. They are badly needed for eastbound freight. Please hurry them home." In a short time this reply was received: "You have also about 400 of our cars. Please use them for your eastbound freight. Most of your cars now on our line are 500 miles south of Cincinnati, and we want to avoid empty mileage until traffic increases." This correspondence immediately and emphatically established the principle of the limited pooling of box cars, and the practical economy of the arrangement that was made in that case will at once suggest itself.

It is the chief aim of a railroad to carry its freight with the best economy and expedition. The prosecution of this purpose leads to the development of all its resources, including locomotives, cars, side tracks and terminal facilities. An indispensable condition of a road having a large traffic is a free supply of freight cars. The general rule on this subject is that each road shall use its own cars in any direction, but shall return foreign cars only in the direction of home. An evil result of this rule is that it brings into the question of car supply the element of selection. The man who has charge of the car supply of any large road will discover from his daily examination of the reports received from each station showing cars on hand that the uppermost question is not, How many cars have we at each station? but How many of the cars that are at each station may we use for our business? If he takes the total sum of all the cars at all the stations, he will probably find that a small proportion of these cars is available for to-day's traffic, while a vastly larger per cent. of the cars on hand must be loaded in specific directions or hauled empty in order to observe the rule for the return of foreign cars. The necessity of selecting a few cars from a great many is the hardship of every railroad in busy times, and in spite of the efforts that are made to carry the freight in cars which should properly go with the traffic, it remains true that a very large part of the correspondence between railroad officials on the subject of cars relates to their diversion.

In order to increase the measure of economy and expedition in carrying freight, as well as to remove the irritation caused by this diversion of cars, it seems necessary to abolish the present practice of selecting certain cars for certain directions, and returning others to their owners arbitrarily and against the flow of the traffic. But if the restrictions in regard to the use of foreign cars were suddenly removed without first providing a sufficient protection, the result would be that the cars would gather at the terminal points where the bulk of the traffic would carry them; for example, in the autumn season the movement of grain eastward and the comparative light shipments of freight westward would accumulate the cars at the seaboard terminals. A piracy of cars would ensue, and the western and lateral roads not reaching the seaboard would be deprived of their equipment and get no other in its place. But let us establish the per diem system as a safeguard against piracy. Let the amount of the per diem charge be based on an upward sliding scale commencing with one cent, to be increased after we have gathered sufficient statistics, until it reaches a permanent sum that will slightly exceed the amount of cost, interest and repairs of each car per day. The present mileage rates ought not to be disturbed until a final per diem charge is established.

It is the intention of this scheme, at least for the present, to omit stock cars and coal cars from limited pooling, as they are especially required for the local traffic of the various roads. Likewise, for obvious reasons, refrigerator cars, furniture cars and all equipment of special kind, will be excluded from this discussion. Now, remove all restrictions in the use of box cars and let us look at some of the results. In busy seasons the Chicago yards of one of the Trunk lines will probably contain 500 foreign cars belonging to Western roads which are awaiting transfer. The owners of these cars will not permit them to move east of Chicago with the freight they contain, but under the limited pooling plan the 500 Western cars would be sent through to the seaboard; while any of the cars that are owned by roads east of Chicago, which arrived at that point for the West, will be permitted to go through to their final destination without transfer. Every day that the 500 Western cars are held at the seaboard the terminal road must pay the per diem charge on each car. The Car Service associations that are now in existence require these cars to be unloaded within 48 hours, and without the per diem arrangement the cars would doubtless be permitted to lie idle until a sufficient traffic would naturally induce their return West. But the limited pooling principle will permit these cars to be loaded either East, West, North or South, while the per diem charge will force the prompt movement of the cars, not homeward at once, it is true, but still it will keep them moving until their accruing daily rental finally drives them home upon the only tracks on which they can stand without being subject to a daily cost. In other words, the only neutral territory is home. The Eastern cars that have been sent west of Chicago will move with equal alacrity and through a like cause. "Keep all foreign cars moving" will be the command of every railroad manager in the country, but instead of moving them in arbitrary directions with inforced empty hauls under the uneconomical conditions which now prevail, they will move entirely without restriction with the volume of the traffic.

The objection may be advanced: "Will not the roads with light equipment be soon divested of cars"? I think the reply should be the negative. All such roads have freight shipped to them as well as from them, and the cars that come to them, no matter who owns them, may be used indiscriminately. But if the outbound shipments exceed the receipts an arbitrary adjustment must be made. A further advantage is this: At the present time the smaller roads that run through grain belts usually call for 100 or 200 box cars before the grain is harvested and hold them 30, 60 or 90 days empty and idle. It has been thought necessary to permit them to do this, because when the greatest pressure of the crop is felt, the cars are so scarce that these smaller roads could not be supplied with enough cars to move their share of the grain. But let us look at this under the new plan. Take a typical road to illustrate this point. It has been known to hold 300 cars three months; but now, when its order for cars comes in, it will not be filled until it is known that the freight is ready for shipment. The trunk line to which this road offers its freight will not then, of course, have 300 of its box cars idle for that road, but it will under the limited pooling arrange with a few of its connections, take the first 300 box cars belonging to those roads that are unloaded at any of its contiguous terminals, and send them to the shipping road in daily quantities to accord with the facilities of that road to load promptly. There will be no delay of three months now, but every resource of the most active management will be exercised to have the cars loaded and moved from that road so as to reduce the per diem charge to its lowest possible amount.

The advantages of limited pooling may be summed up in three points: 1. Every limited pool box car on the road would be considered available for the traffic in any direction. This would reduce empty mileage and car tracing, and avoid complaints of misloading. 2. It would lead to so much greater expedition in the movement of cars, that there could be a large increase in the volume of freight throughout the country without any increase of the equipment. 3. Cars would never lie idle except on the tracks of the owners, because the per diem charge would inevitably keep them moving in one direction or other from the time they left home until their return. The owners would have no special advantage in their home return, however, as the principles of limited pooling would always provide substitute cars.

* A paper by S. H. Church, Pennsylvania lines west of Pittsburgh, read at the Car Accountants' Convention, Indianapolis, June 20, 1893.

TECHNICAL.

Manufacturing and Business.

The Southwestern Bridge & Iron Co., of Fort Worth has been chartered in Texas, the incorporators being R. N. Hatcher, Thomas A. Tidball and C. H. Silleman.

The New York Air Brake Co. has declared a quarterly dividend of 1½ per cent. on the capital stock of the company payable Aug. 1.

Joseph Ellicott has resigned as General Agent of the New York Car Wheel Works, of Buffalo, and has opened an office for general railroad supplies in New York.

In our list of exhibits at the Master Mechanics' Convention, published last week, we omitted to mention the exhibit of W. B. Mack, of Boston. Mr. Mack had a model of a locomotive boiler under steam pressure showing his water circulator. This exhibit attracted considerable attention from members and was a good practical demonstration of Mr. Mack's theory.

The Pulsometer Steam Pump Co., 120 Liberty street New York, reports the spring season just ended as the most prosperous in the history of the company, and in some of the styles its regular stock has become nearly exhausted.

A. T. Shoemaker, of 115 Broadway, New York, has been appointed salesagent for the Ideal nut-lock, manufactured by the Ideal Mfg. Co., of Reading, Pa. This nut-lock is specially adapted for locomotives and cars, railroad tracks, frogs and switches, as well as bridge work. It is made from fine steel, hardened and tempered in oil or lard. Mr. Shoemaker has on hand a complete line of railroad equipment and supplies.

The Northern Pacific will rebuild the car repair shop recently destroyed by fire at Brainerd, Minn.

The Vose & Cliff Co., 115 Broadway, New York, has received an order for supplying King's flexible side bearings for 500 freight cars being built for the Beech Creek Road by the Buffalo Car Mfg. Co. and the Lebanon Mfg. Co.

Iron and Steel.

General Flagler, Chief of Ordnance, United States Army, has divided a contract of over $500,000 between the Bethlehem Iron Co. and the Midvale Steel Co. The former concern will furnish the army with forgings for 8-in. guns, and the latter company will furnish forgings for 10 and 12-in. guns.

New Stations and Shops.

The Boston & Albany has let to Norcross Brothers, of Worcester, the contract for building a new stone passenger station at East Brookfield, Mass.

The New York, New Haven & Hartford is to build a new passenger station at Lee, Mass., on the Berkshire Division, and one at Mount Vernon, N. Y., on the New York Division.

The Boston & Maine will cover all the tracks in its new terminal at Boston with a trainshed. It will be remembered that, according to the plans heretofore printed in the *Railroad Gazette*, the present trainshed, covering the tracks now used by the Lowell division, was to be left standing and the new tracks east of this building left uncovered, light frame roofs being built over the platforms between the tracks. It has now been decided, however, to build a trainshed covering the 17 new tracks. This shed will be 325 ft. wide, and the lower members of the roof trusses will be about 35 ft. from the tops of the rails. Each roof truss will span two tracks and will be supported by iron pillars set in the centres of the platforms. The new part of the headhouse will be built of brick and granite with terra cotta trimmings.

De Kalb's Ventilating Car Window.

The Delaware, Lackawanna & Western has fitted a passenger car with the De Kalb ventilating window, described in the *Railroad Gazette* of July 25, 1890, and the car is now running between Binghamton and Oswego. The special feature of this window is a fastening, with hinges, at the side so that it opens like a door, and fastenings are provided at both sides so that the opening for ventilation can always be made at the rearward side, whichever way the car is moving.

New French Compound Locomotives.

Two new types of 4-cylinder compound, high-speed locomotives, put into service on the Paris-Lyons-Mediterranean Railroad, in France, within the past year, are described in the *Revue Industrielle* of May 20, and elaborate illustrations are given of one of them. As compared with the engines of this road brought out in 1888 and prominent at the Paris Exposition in 1889, the new engines are distinguished because of their greater lightness and increased power, these features being due partly to the use in the boilers of the Serve ribbed tubes.

The two engines are practically alike in their design, except that one of them has a 4-wheeled front truck, while the other has only a 2-wheeled truck. The weights of the engines in working trim are 47.9 and 45 tons respectively; the 1888 engines, on the other hand, weighed 53½ tons. The boilers of the new engines are shorter than those of the older design, the tube length being 3 metres, or about 9.85 ft., and the diameter 65 mm., or about 2.6 in., as against a length and diameter in the earlier engines of 4.035 metres (13.25 ft.) and 50 mm. (2 in.) respectively. With this change in the tube dimensions alone greater lightness would have been secured, but the power of the engines would have remained about the same. To obtain more power, however, the diameter of the boiler was increased from 1.26 meters (4.13 ft.) to 1.32 meters (4.33 ft.), which permitted an appreciable increase in the number of tubes, the boilers of the new engines having 133 tubes, while those of the older ones have only 113. In addition to the use of Serve tubes, a noteworthy feature of the new engines is found in the employment of steel fireboxes, which permitted a reduction in the thickness of the firebox sheets from 15 mm. (0.6 in.), which was customary with the copper fireboxes, to only 10 mm. (0.4 in.). This also helped to materially reduce the weight of the engines. The principal particulars are given as follows:

Total heating surface	1,580 sq. ft.
Number of tubes	133
Grate surface	25 sq. ft.
Diameter of high pressure cylinders	13.4 in.
" " low " "	21.6 in.
Stroke	21 8 in.
Weight of engine, empty	98,252 lbs.
Total weight, working order	105,402 lbs.
Weight on drivers	66,330 lbs.
Extreme length of engine	31.8 ft.
Height, from top of rails to top of smokestack	14 ft.

There are four coupled drivers, each 6.56 ft. in diameter.

A Beton Railroad Bridge in Hungary.

A bridge which, in many respects, recalls the Moiner system, of beton construction, of which so much has been said during the past few years, was recently completed over the River Neutra, in Hungary, and is illustrated and described by Josef Schustler in the *Zeitschrift* of the Austrian Engineers' and Architects' Society, of May 26. The bridge was built according to a system devised by Robert Wünsch, and consists of beton arches in which iron skeleton framework has been incorporated. The ironwork comprises not simply single iron rods, but complete trusses made up of horizontal upper and parabolic lower chords. Cross girders and tie rods, however, have been entirely omitted and are supplanted by the beton. The wooden false-work of the bridge was built to form a series of molds, each mold constituting one complete bridge arch, and after the iron work had been put in place the beton was dumped in and thoroughly rammed. The work was divided up so that the beton filling of each arch was completed in one day, and the false-work was kept in place for an average of 37 days for each arch. The bridge piers also consist of beton. There are, in all, six arches; the total length of the bridge is 115.1 meters (377½ ft.), and the width six meters (19.7 ft.). The whole work of construction was completed in four months, including the time consumed in driving piles for the pier foundations.

An Electric Crane for Steel Works.

An electric crane has been successfully tested at the Edgar Thomson works of the Carnegie Steel Company, Limited. The great traveling crane to be erected in the ladle house of the converting mill of the works was put up last week and a test made. William M. Pierce, electrician of the company at the works, had charge of the test. The crane raised about 100 tons. It will operate ladles exclusively.

Bridge Protection at Sioux City.

In order to protect the bridge across the Missouri River at Sioux City the Sioux City Bridge Co. was compelled to mat and rip-rap the banks for a half mile above the bridge. This work has been done in the same way that other similar work to prevent the erosion of the banks is done. A willow mat is sunk to the bottom of the river, extending above the high water mark; then this mat is covered with broken stone. In this case the mat is 100 ft. in width and has already been sunk and rip-rapped the half mile above the bridge. So far the expense exceeds $30,000, and it is not yet known how far up the river it may be necessary to extend the protection.

THE SCRAP HEAP.

Notes.

Train robberies are becoming so frequent that a special department is required to keep track of them; but none of those reported during the past week have been of much consequence from a financial standpoint. On the 26th it was reported that a third attempt had been made, within the same week, to rob Missouri, Kansas & Texas passenger train No. 3 in Indian Territory. On this occasion the train carried a number of guards and shots were exchanged with the robbers. At Omaha three men who had several times attempted train robberies were arrested, and it is reported that the man who robbed a Northern Pacific sleeping car near Perham, Minn., on June 16 has been arrested.

It is announced that the grievances of certain trainmen of the Central of New Jersey, which were the subject of many newspaper items a few weeks ago, have been satisfactorily adjusted. It is said that additional allowances have been made for overtime. On the same day it is announced from Wilkes-Barre, Pa., that in reducing the forces at the shops of this road at Ashley, Pa., the company discharged the 20 individuals who had formed a committee recently to ask for higher pay (and no others).

Dispatches from Duluth report that the recent losses by forest fires in the region of the Mesaba Iron Range aggregated over a million dollars, besides large losses of standing timber which cannot be estimated. On June 20 several bridges of the Duluth & Iron Range near Tower, Minn., were destroyed by forest fires.

N. Y., P. & O. Life Insurance Association.

The twenty-first annual meeting of the New York, Pennsylvania & Ohio Mutual Life Insurance Association was held at Kent, O., last week. The Secretary reported that the Association had paid 24 death claims during the year, of $1,000 each, and that there was a balance of cash on hand, May 31, of $1,161. The membership May 31, was 2,020, an increase of 88. The following officers were elected: J. M. Booth, Cleveland, President; F. A. Brady, Leavittsburg, Vice-President; G. E. Hinds, Kent, Secretary and Treasurer.

Minnesota State Elevator at Duluth.

The Railroad and Warehouse Commissioners of Minnesota, acting under a law passed during the last session of the legislature, have purchased a site for a state elevator on St. Louis Bay. They have also engaged the Barnett & Record Co., of Minneapolis, to prepare plans and specifications for an elevator of 500,000 bushels capacity. The site is 230×2,500 ft., and extends from the right of way of the Duluth Transfer Railroad to the government dock line. Under the contract with the sellers of the land (they owning an adjoining tract) the state and they each dedicate a strip of land 60 ft. wide and extending back from the dock line 1,000 ft. This will make a strip 120×1,000 ft. The Commissioners estimate the total cost of the elevator, including land, dredging, piling, etc., to be $160,000. They are authorized to build an annex of 1,000,000 bushels capacity, which, it is estimated, will cost $70,000. They will let the contract for the elevator as soon as tenders can be prepared, and when it is completed will operate it until such time as the annex is found to be necessary.

LOCOMOTIVE BUILDING.

Six new class "P" passenger engines are now being built at the Juniata shops of the Pennsylvania, for service between New York and Washington. The first was about finished this week. These engines have 78-in. driving wheels.

CAR BUILDING.

The Pittsburgh & Lake Erie has received seven new passenger cars, manufactured by Harlan & Hollingsworth at Wilmington, Del.

The Receiver of the Waco & Northwestern has applied to the court having jurisdiction for permission to purchase new locomotives and cars.

The Beech Creek road has awarded a contract for building 500 freight cars, dividing the order equally between the Buffalo Car Mfg. Co. and the Lebanon Mfg. Co.

The Jackson & Sharp Co., of Wilmington, Del., is building four hotel cars for Mr. E. G. Allen, Superintendent of the Old Colony. According to a description printed in a Wilmington paper these cars have the kitchen in the middle, and the rest of the car is divided into staterooms after the fashion of the Allen sleeping cars, which are run on the Shore Line between New York and Boston. A peculiarity of these cars, which were described in the *Railroad Gazette* of Oct. 31, 1890, is the zigzag corridor. The staterooms on one side of the car alternate with narrow berths, and on the opposite side of the car the arrangement is the same, the stateroom in each case coming opposite one of the narrow berths. All the berths, both in the staterooms and out, are made wide enough for one person only.

BRIDGE BUILDING.

Chambersburg, Pa.—Old wooden bridges on the Cumberland Valley are being replaced by iron structures. A new bridge has been built over Back Creek at Williamson, and several smaller structures on the Dillsburg branch have been rebuilt.

Concord, N. H.—At a special meeting of the Concord city government last week it was voted to build an iron bridge to replace the wooden one over the Merrimac River on Bridge street, the present structure having been pronounced unsafe.

Florence, Ala.—The last span of the new iron bridge across the Tennessee River at Florence was lowered into position Saturday last. The bridge is now complete with the exception of the approaches on either side, which will be built at once. The new bridge is one of the handsomest structures that span the Tennessee. Traffic was not interrupted during its construction.

Meadville, Pa.—The new high truss bridge over Conneaut Creek at this place will be built by the Massillon (O.) Bridge Co., at its bid of $2,400. It will be 119 ft. long and 24 ft. wide. This company will also construct the single-span bridge at Mercer street, 220 ft. long, at its bid of $10,900. It is, however, to take the old bridge, and the one at Conneautville at an allowance of $1,250. The Venangoboro bridge, a high truss, two-span structure, 260 ft. long and 24 ft. wide, will cost $6,160, and the Conneaut Township bridge, 50 ft. long and 16 ft. wide, will cost $432. These figures do not include the masonry work and the filling in of approaches.

Mt. Gretna, Pa.—A new bridge has been built over the creek at the head of Lake Conewago.

Nation River, Ont.—The sum of $3,000 out of the $7,000 that will be required to construct a bridge at this point has been raised, and the other municipalities interested have promised to make up the balance.

Pittsburgh, Pa.—At a special election on June 20, on the free bridge question, a majority of votes cast were favorable to the issue of bonds for $1,500,000 to purchase the four toll bridges crossing the Ohio and Monongahela rivers and connecting different parts of the city.

MEETINGS AND ANNOUNCEMENTS.

Dividends:

Dividends on the capital stocks of railroad companies have been declared as follows:

Baltimore & Ohio, semi-annual, 3 per cent. on the preferred stock.

Canada Southern, semi-annual, 1¼ per cent., payable Aug. 1.

Chicago, Rock Island & Pacific, quarterly, $1 per share, payable Aug. 1.

Georgia Railroad & Banking Co., quarterly, 2¾ per cent., payable July 15.

Lake Shore & Michigan Southern, semi-annual, 3 per cent, payable Aug. 1.

Michigan Central, semi-annual, 2 per cent., payable Aug. 1.

New Castle & Beaver Valley, quarterly, 1½ per cent., payable July 1.

New York, New Haven & Hartford, quarterly, 2½ per cent., payable July 1.

Norfolk & Southern, quarterly, 1 per cent., payable July 10.

Northeastern (S. C.), semi-annual, 3 per cent., payable July 1.

Richmond, Fredericksburg & Potomac, semi-annual, 3½ per cent., payable July 1.

Rio Grande Western, quarterly, 1¼ per cent. on the preferred stock, payable Aug. 1.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Chicago Junction Railways & Union Stock Yards Co., annual, Jersey City, N. J., July 6.

Marquette, Houghton & Ontonagon, annual, Marquette, Mich., July 20.

Peoria, Decatur & Evansville, special, Peoria, Ill., June 30.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Association of Railway Claim Agents* will hold its annual meeting in the Rookery Building, Chicago, July 11.

The *World's Congress of Engineers* in connection with the World's Fair will hold meetings in Chicago in the week commencing Monday, July 31.

The *American Society of Civil Engineers* will hold its summer convention in Chicago, in connection with the World's Congress of Engineers.

The *New England Roadmasters' Association* will hold its annual convention in Boston, Mass., Aug. 19.

The *American Society of Mechanical Engineers* will hold its summer meeting in Chicago, commencing July 31.

The *Roadmasters' Association of America* will hold its next annual convention in Chicago in October.

The *Western Railway Club* meets in room 730, The Rookery Building, Chicago, on the third Tuesday in each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 7.30 p. m.

The *Northwest Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, except during June, July and August, at 8 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, Bromfield street, Boston, on the third Wednesday in each month, at 7.30 p. m.

The *Western Society of Engineers* meets at 78 La Salle street, Chicago, on the first Wednesday in each month, at 8 p. m.

The *Engineers' Club of St. Louis* meets in the Odd Fellows' Building, corner Ninth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' Society of Western Pennsylvania* meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 8 p.m.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every al-

ternate Thursday except during the months of June, July, August and September.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Tacoma Society of Civil Engineers and Architects* meets in its rooms, 201 Washington Building, Tacoma, Wash., on the third Friday in each month.

The *Association of Engineers of Virginia* holds informal meetings the third Wednesday of each month, from September to May inclusive, at 719 Terry Building, Roanoke, at 8 p. m.

Association of Engineers of Virginia.

The summer meeting will be held at Hotel Rockledge, Mill Mountain, Roanoke, Va., Friday, June 30, and Saturday, July 1. The sessions will be: On Friday, June 30, at 3 p. m. and 8 p. m.; Saturday, July 1, at 3 p. m. (The forenoon of Saturday, July 1, is reserved for visits to points of interest in the vicinity of Roanoke.) The programme announces that the following papers will be read and discussed: "The Proper Method of Disposing of Sewage and Household Waste in Isolated Buildings Where No Drainage System Can Be Made Available," by R. P. C. Sanderson: "An Evaporative Surface Condenser," by Jas. H. Fitts; "Brick Pavements," by Wm. M. Dunlap; "The Improvement of Virginia Highways," by W. H. Newby; "Municipal Building Laws," by Clarence Coleman. L. J. Carmalt is Secretary of the Association.

Engineers' Club of Cleveland.

The meeting on June 13 was called to order by the President, 30 members and visitors present. The application of Harold P. Dyer for active membership was read, and Henry D. Marble and Wm. D. Kearfolk, were elected Associate Members. A brief verbal report of progress was made by Mr. Searles on behalf of the Local Committee on World's Columbian Exposition. A similar report was made by Mr. Porter on behalf of the committee on new quarters. Mr. James Ritchie read a paper on "Preliminary Surveys for a Railroad Line," which was discussed by Messrs. John Eisenmann, John L. Culley, Hosea Paul, W. H. Searles, H. C. Thompson and Jay F. Brown.

Freight Claim Association.

The Freight Claim Association will hold its semi-annual meeting in Detroit, Mich., on Aug. 9, the headquarters being the Hotel Cadillac.

Train Dispatchers' Association.

The annual meeting of this Association was held at Salt Lake City, June 20 and 21, 74 members being present. The total membership is 1,117, an increase of 124 during the past year. A good balance in the treasury was shown. The Committee on Train Rules submitted its report, recommending several changes in the standard code. The next convention will be held at Chicago, in June, 1894. Officers were elected as follows: President, A. F. Vickroy, of Denver; Vice-President, E. A. Smith, of Boston. J. F. Mackie was re-elected editor and executive committeeman.

PERSONAL.

—President Clark, of Union Pacific, owing to ill-health, will take a vacation of indefinite length.

—Mr. W. S. Jones, Superintendent of the Central division of the New York & New England Railroad, with headquarters at Providence, R. I., has resigned.

—The newspaper report that Mr. W. E. Green, formerly General Manager of the "Big Four," had been appointed General Manager of the Cincinnati, Hamilton & Dayton, is without any foundation.

—Mr. John Greenwood, who died at Salt Lake City last week, was the first Master Mechanic of the Denver & Rio Grande. He was formerly a resident of Denver, having moved there in 1870 to take charge of the motive power department of the Denver & Rio Grande. For ten years past he has been in poor health.

—John C. Wait, Associate Editor of the *Railroad Gazette*, has been appointed Assistant Professor of Engineering at Harvard University for five years. This reappointment is an evidence of the esteem in which Mr. Wait is held at Harvard, and is in appreciation of the excellent service he has rendered the engineering department for the six years he has been connected with it.

—Mr. H. H. Vreeland, formerly General Manager of the New York & Northern, was this week elected President and General Manager of the Houston, West Street & Pavonia Ferry Railroad Co., which operates the street railroads in New York City owned by the syndicate known as the Metropolitan Traction Co. These include the Broadway cable road, the Sixth, Seventh and Ninth avenue lines, etc. Mr. R. Somers Hayes, President of the New York & Northern, was elected a director of the company, to succeed Mr. Thomas D. Crimmins, the retiring President.

—Among the graduates of Sibley College, Cornell University, this year, is Edwin B. Katté, a son of Walter Katté, Chief Engineer of the New York Central & Hudson River Railroad, receiving his degree of M. E. (Mechanical Engineer). His graduation thesis—Efficiency Test of the Massillon (Ohio) Heat, Light and Power Co.'s Plant—prepared in collaboration with J. H. Van Buskirk, is said to be one of the best theses ever presented for this degree. Mr. Katté intends to return to Sibley College next term to take the post graduate course in marine engineering and naval construction.

—Mr. Lloyd W. Bowers, recently appointed General Counsel of the Chicago & Northwestern, to succeed W. C. Goudy, deceased, is 34 years of age. He was graduated from Yale College and soon after went west, locating at Winona, Minn. For several years he was a law partner of Judge Thomas Wilson, under the firm name of Wilson & Bowers. In September last Judge Wilson was appointed General Counsel of the Chicago, St. Paul, Minneapolis & Omaha, and Mr. Bowers succeeded the firm as counsel in Minnesota for the Chicago & Northwestern. His record as an attorney has been an unusually brilliant one for one of his years, and, while the appointment was a surprise, it is generally regarded as a well merited promotion.

—At a meeting of the Board of Directors of the Boston & Maine Railroad, at Boston, on June 27, the Hon. Frank Jones was, as has been anticipared, unanimously elected President of the road to succeed Mr. A. A. McLeod. Mr. Jones was President of the road before Mr. McLeod was elected in October, 1892, and he retired then to become Chairman of the Board of Directors, an office that, with the reinstatement of Mr. Jones as President, is now abolished. The Board of Directors also accepted the resignation of Vice-President W. K. Niver, who was formerly with the Philadelphia & Reading and was elected Vice-President of the Boston & Maine soon after Mr. McLeod's accession to the office of President of that company. Owing to the by-laws the vacancies in the Board of Directors will not be filled until the annual meeting in October.

—On the Fourth of July, Everett St. John, General Manager of the Chicago, Rock Island & Pacific Railroad, will have closed his thirty years of service with that company. With the exception of H. H. Porter, Chairman Executive Committee Chicago & Eastern Illinois; Joseph B. Redfield, Auditor of the Northwestern; M. M. Kirkman, Vice-President and Comptroller of the same road, and T. E. Chandler, of the Chicago, Milwaukee & St. Paul, there are no other officers in the service of the roads entering Chicago who were with them when Mr. St. John commenced. Starting at the bottom of the ladder as a clerk, at a very small salary, in the ticket office, Mr. St. John has steadily advanced to his present position, which he has held since April 1, 1889. He has gone through the list, filling all positions, up to the top, and is so thoroughly conversant with all departments of railroad management that there are few men in the country who are able to get at the details of their roads with equal preciseness. He is a hard worker, a close student, and has labored assiduously to bring his system to its present high state. When Mr. St. John commenced his career with the Rock Island it only had 200 miles of road. It has since grown to 1,800 miles.

ELECTIONS AND APPOINTMENTS.

Charleston, Clendennin & Sutton.—The annual meeting was held at Charleston, W. Va., June 22. Kanawha County, W. Va., owns stock in the company, and there was a prolonged discussion over the representation of this stock. The following Board of Directors was elected: W. W. Riley, J. D. Barnes, C. C. Leads, A. L. Ruffner, L. Pritchard, J. Q. Dickinson, A. W. Abney, Frank Woodman and J. M. Payne. On Friday another meeting of the stockholders was held, at which Messrs. J. Q. Dickinson and L. Pritchard resigned from the directory, and Neill Robinson and L. Schwabe were elected to fill their places.

Houston, East & West Texas.—The directors met at Houston, Tex., last week, and elected officers as follows: E. S. Jemison, President; M. G. Howe, Vice-President and General Manager; Thomas Cronin, General Superintendent, and N. S. Meldrum, Secretary and Treasurer. Captain Howe was Receiver of the road from July, 1885, to March, 1893.

Grand Rapids & Indiana.—H. R. Harris has been appointed Master of Transportation, vice William Fitz Gerald resigned.

Indianapolis, Logansport & Chicago.—At the annual meeting of the Board of Directors the following officers were elected: President, E. N. Talbot, Chicago; Vice-President, A. R. Shroyer, Logansport, Ind.; Treasurer, E. G. Cornelius, Indianapolis; Secretary, Q. A. Meyers, Logansport, and Chief Engineer, Walter A. Osmer, Logansport.

Ogdensburg & Lake Champlain.—The largest vote ever cast at an election of the company was cast at the annual meeting at Ogdensburg, N. Y. June 21. Two tickets were nominated for the Board of Directors. The opposition to the management represented the stock and bondholders who are opposed to the consolidation of the road with the Central Vermont system. The total vote was 44,403, and the old board of directors was re-elected by a vote of 31,850 shares.

Ottawa, Arnprior & Parry Sound.—At the annual meeting of the company, held last week, the following directors were elected: P. McCurry, W. Beatty and J. W. Fitzgerald, of Parry Sound, Ont.; John Christie, Francis McDougall, W. Anderson, A. J. Campbell, Gordon B. Green and C. J. Booth, of Ottawa. At a subsequent directors' meeting Charles J. Booth was elected President, and P. McCurry, Vice-President.

RAILROAD CONSTRUCTION,
Incorporations, Surveys, Etc.

Abbeville Southern.—S. G. Pruett, of Montgomery, Ala., who was awarded the contract, a few weeks ago, for completing this work, has already between 400 and 600 men employed on the grading. The work is to be completed by Oct. 1 next to Abbeville, in Henry County, Ala., the northern terminus. The southern terminus will be a point on the Alabama Midland, about six miles west of Dothan Station, and the distance to that point will be 27 miles. The country through which the road is to be built is farming and timber land and is very level, the maximum grade being 66 ft. to the mile, the heaviest work being on the three miles near the town of Abbeville. S. D. McLendon, of Thomasville, Ga., is President, and B. Dunham, of Montgomery, General Superintendent of the Alabama Midland, is Chief Engineer of the new branch.

Atlantic Coast Line.—The extension to Denmark, S. C., which was reported last week as having been just placed under contract, will be built under the charter of the Atlantic Coast Line Co. instead of as an extension of the Manchester & Augusta under that charter. The contract for the grading on the extension has been let to E. S. Moorman, of Lynchburg, Va., and the contract for the five miles of trestle work at Santee River, North Edisto and South Edisto River, has been let to Baldwin & Henderson, a Georgia firm. The road will be 44 miles long, from Remini southwest to Denmark on the South Bound road. That road extends directly south to Savannah, and the connection with it will give the Atlantic Coast Line a much shorter route to that town. All the work is to be completed by Jan. 1 next.

Baie des Chaleurs.—President Armstrong states that the 60 miles of this road now completed has been recently put in regular operation, and that by July 1 the next 20-mile section will be ready for Government inspection. He hopes that by the fall the road will be completed 20 miles further on, bringing it to Paspebiac, Que., and 80 miles east of Metapedia. The first 60 miles is from Metapedia to the Grand Cascapedia River and the next 20 miles is to the Caplin River.

Baltimore & Harrisburg.—Tracklaying on the York branch has progressed as far as the York Fair grounds and will soon reach the centre of York, Pa. The line is about 11 miles long.

Burlington & Missouri River.—The extension of the line beyond Sheridan, Wyo., is being actively pushed by the contractors. The work now under contract is about 20 miles long from Sheridan northwest to the Montana State Line in the direction of Billings, Mont. The line has been located to that point, it is understood, and the right of way has been secured through the Crow Indian Reservation, but not beyond that. Kilpatrick Bros. & Collins now have a considerable force of sub-contractors on the present work and it is thought that the grading will be continued beyond the Montana State Line and through the Indian Reservation towards Billings without any important delay. The track has been laid from Sheridan for about 10 miles.

The extension of the Deadwood Line through the hilly country north of Deadwood, S. D., will, it is announced, be completed to Spearfish, S. D., by Sept. 1. Spearfish is about 35 miles east of Sundance, the county seat of Crook County, Wyo, and the most important town in northeast Wyoming, and it is thought that the road will be continued beyond Spearfish to reach that town.

Butte, Anaconda & Pacific.—The track of the line from Butte to Anaconda, Mont., 25 miles in length, is now being laid with 75-lb. steel rails.

Chicago, St. Paul, Minneapolis & Omaha.—The company is rock ballasting the Eastern Division from Warren west. Last year the company ballasted 11 miles of this division, principally between Camp Douglas and Wisconsin Valley junction. It is the intention of the company to continue this work until the entire division is rock ballasted.

Messrs. Winston Brothers, of Minneapolis, have finished grading the line from Ponca to New Castle, Neb., and the company will commence laying track on July 1. The length of the line is 10.7 miles.

Columbus Belt.—A new plan to construct a belt line around Columbus, O., is being considered. The length of line proposed is over 19 miles and the estimated cost is $1,250,000. The right of way for three miles on the east side of the city has been secured.

Columbus Terminal & Transportation Co.—Work on the company's line is progressing rapidly, and a portion of its track will be ready for use in a couple of weeks. The foundation for the permanent brick freight house has been begun, and the structure will be completed in 60 days. The work of constructing a bridge over the Norfolk & Western, where the terminal tracks leave the line of the Norfolk & Western, will begin in a few days. A change has been made in the plans of the terminal company under which the Columbus, Shawnee & Hocking and the Sandusky & Columbus Short Line will continue, as heretofore, to run their passenger trains into the Union Station. It is expected that the entire work will be completed and in operation by Aug. 1.

Deer Creek.—This company has filed a certificate of incorporation in Maryland of a railroad company to build a road from Belair to the Susquehanna River, between Stafford and Havre de Grace, with the right to construct lateral branches. The capital is $300,000. The incorporators are Noble S. Mitchell, Edward Farney, Frank E. Gorrell and Octavian M. Whitaker.

Fairmont, Morgantown & Pittsburgh.—Tracklaying on the extension of this line and the State Line Road of Pennsylvania, with which it is to connect at the state line, was commenced several months ago, but was discontinued when Smithfield, Pa., was reached on the State Line, and after a mile of track had been laid on the Morgantown end. That made 11 miles of track laid in all, and the work was stopped to allow the tunnel and bridges to be finished. Col. R. S. Irwin, Assistant Chief Engineer of the Baltimore & Ohio, who has charge of the work said last Saturday that the tracklaying had been resumed at Smithfield the Tuesday before, and that it would be resumed on the Morgantown end by July 1. He further said that Morgan's tunnel, the only one on the line, was nearing completion, the side walls being done, and the work of building the brick arch being well under way. The unfinished condition of the tunnel will not delay the tracklaying. Concerning the condition of the roadbed, he said all the slips and washouts except one near Morgantown had been repaired, and said the road would be completed early in the fall. The tracklaying would be pushed as rapidly as materials and men could be put on, working from both ends of the line.

Florence, Cripple Creek & State Line.—It is authoritatively stated that the contract for grading between Florence and Cripple Creek, Col., will not be let at present, as was proposed when the bids were asked a few weeks ago.

Great Northern.—Foley Brothers & Guthrie, of St. Paul, have recommenced the work of rebuilding the Mayville branch. The work was completed to Blanchard, N. D., last fall, leaving 12 miles to be rebuilt. The contractors expect to have the line ready for operation again in six weeks.

The grading of the extension from Park Rapids to Leech Lake, Minn., will be finished before July 1.

Indianapolis, Logansport & Chicago.—One of the officers at the annual meeting last week stated that the company was making arrangements to proceed with the construction of the road at an early date. Nothing more definite than this statement has been published. The line has been surveyed between Logansport and Indianapolis, 70 miles, but the only actual work done is on a short section near Logansport.

Kanawha & Michigan.—The Gauley River branch of this road is now completed, and, as reported last week, through trains will begin running as soon as the Chesapeake & Ohio makes a junction with the branch, which will probably be in July. The branch of the above road is 31.5 miles long, and follows the east bank of the Great Kanawha River from Malden, W. Va., to the mouth of the Gauley River, passing Black Diamond, Shrewsbury, Monarch, Enterprise, Cannelton, Kanewha Falls and Ganesy.

Kingfield & Dead River.—The Maine Railroad Commissioners have approved the articles of association of the railroad company, which will build a road from the terminus of the Franklin & Megantic at Kingfield, 10 miles further into the woods at Jerusalem, Me.

Little Miami.—Tracklaying on the relocation of the route of this road into the Columbus Union Station has begun. The building of the new roadbed took 45 days and 20,000 cu. yds. of earth were excavated and removed.

Maxwell Land Grant Co.—The management of the Maxwell land grant, of northern New Mexico, is surveying a line for a railroad to extend from Raton to Catskill, N. Mex., a distance of 15 miles. The company will ask the Union Pacific to operate the line.

Nevada Southern.—The official announcement is made of the opening of this road for regular traffic. The road is located in San Benardino, Cal., and it is now completed from Blake station, formerly Goff, on the Atlantic & Pacific to Purdy, a distance of 20 miles. Manville and Vanderbilt, the mining camps, are four and 10 miles, respectively, from Purdy, but good wagon roads meet the railroad trains at Purdy.

New Boston.—This road was opened for general traffic on June 22. The road has been leased to the Concord & Montreal, and extends from Goffstown or Parkers Station, a town on the North Weare branch of that line, north of Manchester, N. H., and extends southwest to New Boston about 5½ miles. The new road was built last year and has grades of 3 ft. to the mile, the maximum curves being six degrees, all in the town of New Boston.

New Hamburgh & Poughkeepsie Connecting.—The incorporation of this company was noted last week. The road which it is proposed to build is to extend from the Hudson River west of the New York Central road, and at New Hamburgh to and through the village of Wappinger Falls, thence northeasterly to the Poughkeepsie & Eastern, and to the Philadelphia, Reading & New England, about 12 miles in length. It is about five miles east of the Hudson River at one point. The surveys are already made. The work is light with grades not over 52 ft. to the mile, and the curves are less than 6 deg. One iron bridge 100 ft. will be built at New Hamburgh and a trestle about 20 ft. near the Poughkeepsie & Eastern Railroad. The road is to be constructed for heavy freight traffic, but is to be operated by electricity. John P. Wilson, of Poughkeepsie, is President, and G. O. House, of Poughkeepsie, is Chief Engineer.

Ohio River.—This company is making extensive improvements on the 11 miles of its line between Wheeling and Moundsville, W. Va. The long trestles Nos. 6, 7 and 8 are being filled in, and the roadbed is being improved and strengthened at all points along the line. About 40 miles of track will be relaid this summer, and the passenger service is to be improved by putting on new trains.

Ottawa, Arnprior & Parry Sound.—The contract for building from Arnprior, Ont., west to Serson's has been sublet by Fauquier Bros. to other contractors. From Serson's to Eganville, Fauquier Bros. will build the line, without sub-contracting it.

Passaic Elevated Transit.—A mortgage for $2,000,000 was filed last week in Hudson County. It was executed by the above company in favor of the Farmers' Loan & Trust Co. The railroad is to be a double track, elevated structure, and to extend from West Side avenue, at the west slope of Jersey City Heights, to Broad street, Newark. The road will be 5½ miles long.

Pittsburgh, Virginia & Charleston.—It is reported that the contract for the grading of this line from Brownsville, Pa., to the mouth of Ten Mile Creek is to be let this week. The work of securing the right of way for the lines recently surveyed from Brownsville along the Monongahela valley is going on rapidly. This is a continuation of the line which is known in West Virginia as the West Virginia & Pennsylvania, and which is to join it in the Monongahela valley at the State line.

Quebec & Lake St. John.—The Chicoutimi extension of this railroad is nearly completed and the formal opening will probably take place in July. The extension is about 51 miles long, and begins at Chambord, and extends east to Chicoutimi, Que.

Seattle & Northwestern.—A party of engineers is engaged in making a preliminary survey for the route from Seattle, Wash., in a northeasterly direction, to a junction with the Great Northern Railroad at some point west of the Cascade Mountains. The contracts for grading will not be let until the line is definitely located, which will not be for a couple of months. The character of the work to be done is not difficult, and the maximum grades will not exceed 30 ft. to the mile. Thomas Burke, of Seattle, is the chief local projector.

Southern Pacific.—The mileage of this company in Southern California is being increased by the acquisition of small lines and the construction of new branch lines into unoccupied territory. On June 12 this company completed the purchase of the San Gabriel Rapid Transit road, and is now regularly operating it. This line extends from Los Angeles to the town of Monrovia, a distance of about 18 miles, and passes through a region profitable for local freight and especially for heavy orange shippers. Until the acquisition by the Southern Pacific it had been operated as the Monrovia Division of the Los Angeles Terminal Railway Co. As the road was originally narrow gauge, the bridges were too light for heavy traffic, and the new owners are now making arrangements to provide new and substantial structures.

The ordinances have been passed and the rights of way obtained for a branch line of the company from Pomona, Cal., by a new route to Chino and thence to Riverside. Chino is the site of a large beet-sugar factory, while Riverside probably ships more oranges than all the rest of Southern California. The total new mileage in this division will be about 20 miles.

The line westward from Burbank in the San Fernando valley, now under construction to Chatsworth Park, is rapidly proceeding and will make as its eventual destination the port of Hueneme on the Pacific. About 25 miles will be embraced in this new line to the coast.

At Port Los Angeles remarkable development is in progress. Probably the longest pier in the United States has been completed, the length being but a few hundred feet short of a mile. To reach this pier six miles of new track has been added to the Santa Monica division of the Southern Pacific, and on the pier itself two more miles of track are laid. Through the facilities offered by this pier vessels can now discharge direct to cars with a minimum of handling.

Union Pacific.—Officials are examining the Snake River mining district in Colorado with a view to building a branch from Keystone, on the South Park line. The extension will be seven miles long.

Wheeling Bridge & Terminal.—Work on this company's extension to Benwood, W. Va., is progressing rapidly and will be done within three months. The piling is being put in at the lower end of the city of Wheeling, and trestles are building at several of the heavier points along the proposed line. The tracks will be put in as far as the Riverside Iron Works in the upper part of Benwood at the earliest possible day, and will be continued to the Wheeling Steel Works and other shipping points in Benwood later. The same company is also at work on a new short line from Jonathan's Ravine, between its two long tunnels, to a point on the side and foot of Wheeling Hill, where it will connect with the Pan Handle road. There is already a connection with the Pan Handle, but it is a roundabout way, and makes the running of passenger trains into the Union Station impossible. It is reported that the Pan Handle has made arrangements with the Terminal Co. for the use of its tracks and Union station, which report is made more plausible by the fact that the City Council of Wheeling has repeatedly refused to vacate a part of the public wharf which the company wanted for a site for its proposed new passenger station.

GENERAL RAILROAD NEWS.

Charleston, Clendennin & Sutton.—A meeting of the stockholders of this road was held at Charleston, W. Va., June 22. The reports showed that the line has been completed from Charleston to a point 20 miles up Elk River and that the company has no funds to continue the line further. The question of equipping the road with rolling stock and extending it to Sutton, W. Va., was discussed, and a committee consisting of A. L. Ruffner, Frank Woodman and J. D. Barnes was appointed to prepare a plan for mortaging the road now completed for $300,000 to be used in purchasing the rolling stock. There are 21 miles of the line in operation and the road is said to be meeting its expenses.

Cleveland & Southwestern.—This company has filed articles of incorporation increasing its capital stock from $1,500,000 to $2,500,000. The company proposes to build a road from Brooklyn, a suburb of Cleveland, to near Medina, O.

Lake Shore & Michigan Southern.—The company makes the following report for the six months ending June 30 (June estimated):

	1893.	1892.	Inc. or dec.
Gross earnings	$11,744,000	$10,678,656	I. $1,065 344
Oper. expenses	8,283,206	7,417,890	I. 865,316
Net earnings	$3,460.794	$3,260.766	I. $200,028
Fixed charges	1,680.000	1.680.000	.....
Profits	$1,780,794	$1,580,766	I. $200,028
Dividends	1,483,995	1,483 995	.....
Surplus	$296,799	$96,771	I. $200,028

Marietta & North Georgia.—Judge Newman, of Atlanta, has promulgated a decree postponing the sale of the railroad till Oct. 10. The road was to have been sold under the original decree this month, but several of the creditors protested against that programme.

Michigan Central.—The report for the six months ending June 30 (June estimated), is as follows:

	1893.	1892.	Inc. or dec.
Gross earnings	$7,550,000	$7,642,.00	D. $92,600
Oper. expenses	5,785,000	5,732,000	I. 53,000
Net earnings	$1,765,000	$1,910,000	D. $145,000
Fixed charges	1,200,000	1,200,000	.....
Surplus	$565,000	$710,000	D. $145,000
Canada South'n's proport'n.	162,000	184,000	D. 22,000
Mich. Cent. proportion	403,000	526,000	D. 123,000

Omaha & St. Louis.—On application of the United States Trust Company of New York, holding a mortgage of $2,717,000 on the road, Judge Woolson, of the United States Court, has appointed John F. Barnard, ex-President of the Ohio & Mississippi Railroad, receiver for this railroad, which extends from Council Bluffs to St. Louis, and which has been operated by the Wabash.

Philadelphia & Reading.—The plan for the readjustment of the railroad and coal and iron companies was finally abandoned by the Board of Managers on June 22. Under the conditions attached to the plan, the assent of the holders of $41,828,000 general mortgage bonds and 480,424 shares of stock to certain of its provisions was required, while the total amount of assents obtained was only $31,356,000 and 411,218 shares of stock. The question of extending the time of assenting to the plan for two weeks was discussed, but the resolution to abandon the plan was adopted by a unanimous vote. The failure of the plan was due mainly to the opposition of the New York bondholders, who would not consent to the funding of their coupons for five years as proposed in the plan.

President Harris, on the same day, issued a statement to the security holders, in part as follows: By the terms of the plan it was provided that if the assent of the requisite number (including over 90 per cent. of the general mortgage bonds and 60 per cent. of the shares) should not be secured by June 21, the subscribers to the proposed issue of collateral trust bonds and general mortgage coupon trust certificates would be released. The subscriptions were made upon this condition, and as it is not possible at the present time to have such subscriptions renewed or extended the plan must now be abandoned and the subscriptions released. It is possible that the many friends of the company in this city and New York who have united in asking that the holders of the outstanding shares and securities should be given until after July 1, when the general mortgage interest will mature, may be correct in thinking that the requisite number of assents would thereby be secured, but a new subscription to the proposed issues of collateral trust bonds and coupon trust certificates would also be required, and this cannot even now be made up.

St. Louis & San Francisco.—Judge Withrow, of St. Louis, this week decided the cases of the state of Missouri against the railroad company, in favor of the defendant. The action was to recover $700,000 interest and principal alleged to be due from the defendant as the successor of the "Southwest Branch" of the Pacific Railroad Company, on a guarantee of the latter to repay to the state $300,000 advanced for its construction.

TRAFFIC.

Traffic Notes.

The Great Northern is selling 3,000-mile tickets, good throughout its system and valid for one year, at $75 each.

The number of overland passengers carried by the Southern Pacific in May was 11,503 eastward and 7,518 westward. For the same month last year the number eastbound was 7,633 and westbound 8,663.

The Cleveland, Lorain & Wheeling Railroad has put on through Wagner sleeping cars between Wheeling and Chicago, by way of Elyria and the Lake Shore & Michigan Southern. This addition to the service was put on as an experiment, and is proving satisfactory and profitable.

All the roads centering in Columbus, O., have entered into an agreement which abandons the long-established custom of giving state employés a passenger rate of one cent a mile upon all occasions, and hereafter such passengers will be charged full fare.

The Pennsylvania announces a new train, the Atlantic Coast Line Express, to leave New York at 9:00 a. m. It connects at Washington with the through train which has hitherto left there for the south at 10:57 a. m., so that passengers make the same connections as have heretofore been made by the train leaving New York at 12:15 a. m.

The Grand Trunk and the Philadelphia & Reading have established a new fast freight line between New York and Chicago. This is apparently one of the results of the partial severance of through traffic relations between the Grand Trunk and the West Shore. The new fast freight line is called the "Reading Dispatch."

The roads in the Colorado-Utah Association have agreed to reduce the fare between Colorado common points and Utah common points on July 1 from $25 to $20. The round-trip rate is also reduced $5. The Canadian Pacific has reduced passenger rates between St. Paul and the Pacific Coast to correspond with the new tariff established by the Great Northern. The Northern Pacific announces an all-rail fare between St. Paul and San Francisco of $45 first class and $40 second class. The Great Northern has reduced a large number of commodity freight rates to Montana and Washington points about 10 or 15 per cent.

The "seaboard pool" of Southern California has been broken by the Redondo Railroad formally withdrawing from the combination. This pool was organized for controlling both sea and water rates for all classes of freight entering Southern California from the Pacific seaboard. The parties to the compact were: The Atchison, Topeka & Santa Fé, the Southern Pacific, the Los Angeles Terminal and the Redondo railroads, the Pacific Coast Steamship Company and the Banning Brothers' Transportation Company. By the terms of agreement Redondo Beach and San Pedro were to be favored ports of entry, and the railroads agreed to favor the Pacific Coast Steamship Company as against all other freight vessels.

Chicago Traffic Matters.

CHICAGO, June 28, 1893.

Passenger rates East are being maintained generally, but many of the lines are becoming restive, owing to alleged manipulations by the Nickel Plate in manipulating the market through brokers and steamship agents.

Transcontinental rates, both freight and passenger, are becoming more demoralized daily, and there seems little probability of anything approximating tariff rates being restored for some time. In fact, the probabilities are that rates will go lower before being restored.

It is reported that the railroad clearing-house scheme for settlement of local freight balances has received the signatures of 22 presidents of Chicago roads, and the indications are that it will go through.

Commissioners Walker, Blanchard and Donald, acting as special arbitrators, have decided in favor of the Baltimore & Ohio in a complaint made by the other Chicago lines that the establishment by that company of a ticket office at its junction with the Illinois Central at Stony Island avenue was a violation of the agreement allowing but one city ticket office. The arbitrators in their decision find that the location of the office in question is not such as to influence World's Fair traffic, and also suggest the desirability of a union bureau of information on the Exposition grounds.

The Chicago passenger men are complaining loudly because the Pennsylvania has opened its city ticket office on Sunday, and also keeps it open after 6 p. m. on week days. The Pennsylvania people justify their action on the ground of exceptional volume of travel which cannot be taken care of at the depot office. They have agreed, however, not to keep open in the evening and for only two hours on Sundays. It is not probable that the other roads will open on Sundays.

At a mass meeting of General Passenger Agents of lines in the Central Traffic Association, held June 21, it was voted to modify the action taken June 8 establishing special train coach excursions to Chicago on account of the World's Fair, by extending the limit of four days, including date of sale, to seven days, including date of sale, from points 200 miles distant from Chicago, and to 10 days from points distant 325 miles or more. It was voted to recommend to the managing officers the authorization of a rate of one cent a mile in each direction, short line distance, for the transportation of National Guard in uniform, traveling as regimental organizations.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines, for the week ending June 24 amounted to 55,246 tons, against 59,670 tons during the preceding week, a decrease of 4,424 tons, and against 57,904 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	W'k to June 24		W'k to June 17.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	6 885	12.5	7,657	12.8
Wabash	3.157	5.7	3,773	6.3
Lake Shore & Michigan South.	9.927	18.0	12.101	20.3
Pitts., Ft. Wayne & Chicago	6.856	12.4	8,308	13.9
Pitts., Cin., Chicago & St. Louis	6,024	10.9	6,335	10.6
Baltimore & Ohio	3,835	6.9	3,811	6.4
Chicago & Grand Trunk	2.803	5.1	3,387	5.7
New York, Chic. & St. Louis	6,855	12.4	5,298	8.9
Chicago & Erie	6,256	11.3	6,596	11.0
C., C., C. & St. Louis	2,648	4.8	2,134	4.1
Totals	55,246	100.0	59,670	100.0

Of the above shipments 1,999 tons were flour, 21,040 tons grain and millstuff, 7,746 tons cured meats, 11,234 tons dressed beef, 2,274 tons butter, 1,749 tons hides and 7,641 tons lumber. The three Vanderbilt lines carried 42.9 per cent., the two Pennsylvania lines 23.3 per cent. The Lake lines carried 82,395 tons, against 92,481 tons during the preceding week, a decrease of 10,086 tons.

Other Chicago traffic news will be found o page 491.